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SMITHSONIAN DEPOSIT.

Riter-Conley Manufacturing Company

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Pittsburgh

THE UNITED GAS IMPROVEMENT COMPANY,

PHILADELPHIA.

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THE STANDARD DOUBLE SUPERHEATER

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OF

AIR AND STEAM SUPPLY

(PATENTED),

AFFORDING { PERFECT CONTROL OF GENERATOR FIRE CONDITIONS.

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THE AMERICAN
GAS LIGHT JOURNAL

VOL. XCVI., No. 13. **NEW YORK, MARCH 25, 1912.** WHOLE NO. 1,920.

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Color Discrimination by Artificial Light.

[Communicated by "ABROAD."]

A very interesting paper on this subject was read by Mr. T. E. Ritchie before the Illuminating Engineering Society, London, in mid-January, and as a prefatory line let me note there can be no question of the extraordinary variety of trades and business to which this question is of importance. The lecturer commenced by pointing out its interest to drapers, manufacturers of colored paints and pigments, carpets in three-color process and lithographic work, etc., to florists, artists and in many others. In some cases the matter is so vital that business comes to a standstill when daylight fails because no other form of artificial light is thought near enough to daylight to be really satisfactory.

Mr. Ritchie, therefore, set to work to study the effects of various illuminants on colored objects with a view to finding out which of them approached daylight most closely. This is a subject on which one hears the most divergent opinions expressed. For example, it is frequently contended that arc lamps give the best practical result, others claim the best results for acetylene and one form of light, the Moore carbon dioxide tube which has been used to a considerable extent for this class of work, is little known in England at present.

Mr. Ritchie attacked his problem in several differing ways. He selected a series of ribbons of a great variety of tints, which ribbons were photographed in turn by all the illuminants studied, a special form of plate and filter being used which is claimed to give a result almost identical with the impression received by the human eye. By comparing these photographs with that obtained by diffused daylight one could readily see in which cases the tone-values agreed most closely with the ideal. Naturally special precautions were taken to develop all photographs under identical conditions in the different cases. Amongst other tests Mr. Ritchie also tabulated the appearance of this set of ribbons as seen by the eye, by each of the illuminants his results being summarized in Table I.

TABLE I.—*Changes in the Appearance of Colored Objects Under Different Lights.*

Description of Light Used.	Appearance	Colour.					
		Brown.	Red.	Green.	Mauve.	Blue.	Orange & Yellow.
Bright Diffused Daylight	Bluish White or Pure White	Normal.	Normal.	Normal.	Normal.	Normal.	Normal.
Inverted O.I Arc Lamp	Bluish White or Pure White	Normal.	Slightly Brighter Than Normal.	Normal.	Slightly Darker Than Normal	Normal.	Normal.
Enclosed Arc Lamp	Bluish White	Darkened.	Lightened Several Shades	Darkened Considerably	Darkened Slightly.	Darkened Slightly	Darkened Slightly
Metallic Filament Incd Lamps	Yellow White	Lightened & changed to Reddish Tint	Lightened Many Shades.	Darkened & Changed to a Yellower Tint.	Changed to Redder Tint	Darkened & Changed to Purplish Colour.	Brightened & Changed to a more Orange Shade.
Inverted Incandescent Gas	Greenish Yellow	Darkened.	Lightened Many Shades	Darkened & Changed to a Yellower Tint.	Darkened & Changed to a Redder Tint	Darkened & Changed to a more Navy Blue	Brightened Many Shades.
Carbon Filament Incd Lamps	Orange Yellow.	Reddened in Tint.	Lightened Many Shades.	Darkened & Changed to a Yellower Tint.	Darkened & Changed to a Pinker Tint	Darkened & Changed to a much more Purple Colour	Brightened & Changed to a deep Orange.
Ordinary Gas Light.	Yellow.	Reddened in Tint	Lightened Considerably	Changed to a Yellower Green.	Changed to a Pink Rose Coloured Tint	Darkened & Changed to a more Navy Blue	Brightened & Changed to Orange.
White Flame Arc Lamp.	Bluish White.	Slightly Reddened in Tint	Lightened Many Shades	Changed to a Yellower Tint & Lightened Slightly.	Changed to a Bluer & Darker Shade.	Brightened & Changed to a more Intense Blue	Changed to a deeper & more Orange Colour
Yellow Flame Arc Lamp.	Deep Yellow.	Darkened Slightly	Changed to a Brick Red	Deadened & Changed to a Yellower Colour.	Darkened Considerably & Changed to a Purple	Darkened & Changed to a more Navy Blue.	Changed to a deeper & more Orange Colour.
Mercury Vapour Lamp.	Pale Blue-Green	Changed to a Greenish Colour	Changed to almost Black	Lightened Considerably	Changed to a Slate-Blue Grey.	Deadened	Changed to a Greenish Yellow.

It will be seen that only in the case of the inverted arclight were the colors almost "normal" throughout.

Another method used was to ascertain the reflecting power of the series by each illuminant. It is well known that the amount of light reflected by a colored surface depends not only on its nature but also

on the quality of light by which it is illuminated; consequently if the reflecting powers prove to be identical throughout with those obtained by diffused daylight, we have strong evidence that the color of the light from this illuminant is also not far removed in quality from that of normal daylight. The last test applied consisted of analytical tests with the "tintometer" apparatus in which various combinations of glasses are used to imitate any prescribed tint. These results are shown in Table No. II.

TABLE II.

No.	Colour.	Percentage of Light Reflected, Daylight Illumt. 5-6 Foot Candles	Colour Analysis, Lovibond's Nomenclature. Tests by Tintometer Colour Box.						
			Light Brighter than Standards	Matching Standards.			Colour Developed.		
				Red.	Yellow	Blue.			
1	Black.	3·0	——	12·0	12·5	14·0	Black 12·0	Green, 0·5	Blue 1·5
2	Light Brown.	6·3	——	11·5	11·0	7·8	Black 7·8	Orange, 3·2	Red 0·5
3	Crimson.	8·2	——	21·5	3·2	2·1	Black, 2·1	Orange, 1·1	Red, 18·3
4	Olive Green.	10·5	——	3·8	17·0	7·4	Black, 3·8	Green, 3·6	Yellow. 9·6
5	Cerise.	12·0	——	23·0	1·65	——	Orange, 1·65	Red, 21·35	——
6	Dark Mauve.	8·5	——	8·4	0·7	5·0	Black, 0·7	Violet. 4·3	Red. 3·4
7	Deep Emerald Green	9·5	——	——	9·0	10·2	Green, 9·0	Blue, 1·2	——
8	Cobalt or Sky Blue.	21·0	——	——	1·05	6·4	Green 1·05	Blue. 7·35	——
9	Deep Orange Yellow	33·0	N.T ·02	10·4	7·6	——	Orange. 7·6	Red, 2·8	——
10	Yellow.	60·0	——	5·0	9·6	——	Orange. 5·0	Yellow, 4·6	——
11	Pale Mauve.	45·0	——	2·8	0·4	2·2	Black 0·4	Violet, 1·8	Red, 0·6

From all these tests Mr. Ritchie drew the conclusion that indirect arc lighting was the closest illuminant (among those studied) to daylight. Incandescent gas (low pressure) and tungsten electric lamps appeared about equally removed from daylight. Acetylene, it may be noted, was not included among the illuminants, and it was also pointed out, in the course of the discussion, that high pressure incandescent gas would no doubt give rise to better results than ordinary low pressure burners, the color being of a distinctly whiter tint.

The discussion aroused by the paper was quite as interesting in its way as the paper itself. One of the points raised by Mr. Haydn Harrison will doubtless appeal to many of those interested in these matters; namely, that a dress which is to be worn under artificial light should be chosen by that light and not by daylight. On the other hand it is clearly unsatisfactory for shops containing these articles to be lighted by all sorts of illuminants, as at present, with the result that the colors may be quite different from what they will actually appear in the evening.

Mr. Leon Gaster also referred to this point, and suggested that the conditions in certain classes of textile work, where very fine and accurate, standard colors were aimed at, were somewhat different from those in a draper's or a florist's shop where a lower degree of accuracy in approximation to daylight might answer. Another point talked was how greatly daylight itself differed with different climatic conditions; certainly in cities where a certain amount of fog was usual one got different results from those in the country. This point was strongly emphasized by Mr. A. P. Trotter.

What, however, was perhaps the most interesting feature in the discussion, was the exhibition (by Dr. Kenneth Mees) of a new form of daylight unit, consisting in one tungsten lamp, equipped with a suitable reflector and covered by a form of light-filter, which converted the light into a close resemblance to daylight. It may be noted that a filter of this kind has also been devised by Dr. H. E. Ives. A number of experiments were shown by this light. Not only was the difference in appearance of daylight and artificial light strikingly shown with various colored ribbons, but some specially dyed artificial flowers were also exhibited. Some of these appeared quite satisfactory by daylight, but were a hideous "clash" of colors by tungsten light. Others were so tinted as to appear quite pleasing by artificial light, but drab and monotonous by daylight. Naturally a filter of this kind absorbs a considerable amount of light (possibly as much as 75 per cent.), but in many cases this is of comparatively small consequence provided an accurate reproduction of daylight is secured It was not suggested that such units should be used as a substitute for ordinary artificial illuminants for lighting interiors, but only that they might be very convenient for lighting up a small cabinet with "artificial daylight" so that accurate color matching could be carried out.

The most interesting point about this method of imitating daylight is that it might concievably be applied to other illuminants. If, by the insertion of a suitable screen, one can convert the light from tungsten lamps into artificial daylight, why should not a screen be found to do the same for incandescent gas lights? Indeed, one might even suppose that a series of screens could be contrived which would convert light from an incandescent gas light into daylight, or light similar to a tungsten lamp, an arc lamp, etc. If this could be done it would be possible for a draper, for example, to prepare a series of cabinets in which all these lights were arranged so that a customer could readily ascertain the appearance of a colored object, as in the case of all the chief modern illuminants.

In conclusion another point that suggests itself is the possibility of lighting picture galleries artificially so as to enable all the colors of pictures to be seen as perfectly as by daylight. Mr. J. Eck, in the course of the discussion, suggested that indirect arc lighting came sufficiently near daylight for this to be conceivable and, in support of this suggestion, he showed a picture the painting of which had been done, in alternate lines, by daylight and by indirect arc lighting. The resemblance of the spectra of these lights was shown by the fact that the picture looked quite homogeneous, and no marked difference in color could be seen between the two sets of lines.

Whatever may be one's conclusions as to these points, however, there seems no doubt that the color of artificial illuminants will play an important role in many industries in the future, and that questions of cost may even sometimes be of small consequence in comparison.

[OFFICIAL REPORT FURNISHED BY THE SECRETARY—CONTINUED FROM PAGE 186.]

FORTY-SECOND MEETING, NEW ENGLAND ASSOCIATION OF GAS ENGINEERS.

HELD IN YOUNG'S HOTEL, BOSTON, MASS., FEB. 14 AND 15, 1912.

FIRST DAY—MORNING SESSION.

Discussion on the Wing Paper.

The President—Gentlemen, having heard the reading of Dr. Wing's paper, I hope you will feel free to discuss it. Mr. Miller will you start the discussion?

Mr. Miller—I have not studied the paper particularly, Mr. President, but I would like to ask Dr. Wing a question. I do not think he has put it in such form here, but what is his average amount of gas purified per bushel of shavings—I believe that is the usual way to express it—and how high are the scrubbers? I think he said he put in 2 feet of shavings to each layer. Wouldn't it be more economical possibly, to have 4 layers and maybe 4 feet of shavings to each layer?

Dr. Wing—The amount scrubbed per bushel will be about 72,000 cubic feet. These scrubbers are really too small in diameter for our rate of make. We had 3, and have added another. We had from the first considerable difficulty in getting shavings that were not too small or powdery, that would mat together and cause high back pressure quickly, and long before they were saturated with much tar. I am sure in our case we could not very well have more than 6 feet in each one; that is, 3 layers of 2 feet each. There is an advantage, I think, in having shallower layers than Mr. Miller suggests, 4 feet or 6 feet deep, because they will not pack so tightly at the bottom of of a layer.

Mr. Miller—The shavings scrubbers that I have had more or less to do with were about 10 feet in diameter and possibly 30 feet high, and they had, I believe, 4 layers of either 4 or 6 feet deep each, and then we only dumped out 1 layer and blew in fresh shavings to the upper layer. With these scrubbers the amount per bushel was way above what Dr. Wing gets.

Dr. Wing—To answer Mr. Miller's last remarks, I would say that the shavings are cheap and they are foul when they come out. We undertook at first to change as he suggested, dropping out the bottom layer and letting the others down, but although the top layer was not tarry, it was very wet and well packed. On account of the slight cost, etc., it seemed best to throw it all out.

The President—We would like to hear from Mr. Ramsburg on this subject.

Mr. Ramsburg—The quantity of entrained vapor in a gas is a question of the dewpoint of the gas and its temperature. Consequently, if this gas has been cooled to 90° while passing through the tar extractor, and continuing its course it is still allowed to continue to cool, the vapor will be in equilibrium with the gas at 90° as it passes the extractor, and no matter how efficient the extractor may be as the gas cools in continuing its path, there will be vapor dropped out. This will also continue after passing the shaving scrubber. The question comes up largely whether a shaving scrubber is really a necessity if it is possible, after the gas has passed an efficiently working tar extractor, to continue to maintain its temperature above its dewpoint. In other words, if you passed the gas through a P. & A. type tar extractor at 90° to 100°, extracted 95 per cent. of the tarry

vapor, and then warmed that gas slightly above its dewpoint, it would carry those vapors through the purifiers. In our Philadelphia works we do not use shaving scrubbers, nor have we felt the need of using them, because we maintain the temperature of the gas after it has passed the extractor until it is through the purifier. It seems to me the efficiency of the tar extractor here is not very high. Of course, if you cool your gas to 90° before it goes through the tar extractor the amount of vapor taken out by the extractor is very much heavier than if it is cooled to the critical temperature, which is 105° In other words, in cooling the gas to 90° considerable hydrocarbon vapor is taken from the gas, which, if carried through the purifiers, would aid in securing candle power even to the burner. So that the critical point at which a tar extractor may be used is approximately 105°, under which conditions, if it is maintained at 105° through the purifiers, there will be very little deposit in the purifiers themselves, and I see no particular object in using a shaving scrubber.

Mr. Kennedy—I would like to ask Mr. Ramsburg what means they use at the Philadelphia works to increase the temperature after leaving the P. & A., to what extent that temperature is increased, and how far it is maintained.

Mr. Ramsburg—We maintain the temperature through the purifiers by pipe coils in the bottom of the boxes. It requires a very small amount of steam to heat the gas above its dewpoint, and at times in some of our purifiers we simply admit live steam to the inlet of the boxes. The water dewpoint under those conditions will, of course, increase, but the hydrocarbon dewpoint will remain constant, and you will increase the temperature above the dewpoint at which it will be deposited in the oxide. In this connection I might say that recently I have been experimenting with a very interesting method of discovering the efficiency of a tar extractor. It consists of using three U-tubes in series, in which the middle one contains calcium chloride, the other two cotton. The 3 tubes are merged in water maintained at the temperature of the gas in the main. The first tube is dried to constant weight, and the gas is passed through the 3 tubes. Having secured a measured quantity of gas in this way, the deposit from this measured quantity of gas will be accumulated in the first tube. The calcium chloride in the second tube will remove all the water vapor, and the third tube will pass gas through it which has had both the entrained hydrocarbon vapor and the water removed at the temperature of the gas in the main. It is, therefore, only necessary to reverse these 3 tubes and pass more gas. Under which condition perfectly dry gas at the same point of equilibrium as the gas which originally passed, will pass through what was initially the first tube, so that the tube, which was the first tube, will be dried of water vapor by gas which is in exact equilibrium with the gas in the main. Consequently, the weight of tar remaining in the tube will represent the amount of tar remaining in the gas and nothing but that amount of tar. It has been very difficult to find a method which would give exact results, and I think this does.

Mr. Kennedy—May I ask if Mr. Ramsburg's boxes are the upflow entirely; or are they triplex boxes? It seemed the heating of steam coils in the triplex box would be a little more difficult than in the ordinary upflow box.

Mr. Ramsburg—All our boxes at the present time in water gas are up-flow. We tried some on down-flow, but it is much more difficult to keep the gas at the proper temperature going through the box. At this time we are using very few pipe coils, because they eventually eat out. The live steam method is preferable, I think.

Mr. Miller—Mr. Ramsburg says that shaving scrubbers are not necessary in his case, because he keeps the temperature of his purifiers up to 105°, I think, thus retaining some of the tarry vapors, which I believe is about 5 per cent. But those tarry vapors must drop out somewhere, since you cannot keep the gas up to 105° after it gets into the holder or mains. Consequently I don't see where he gains anything in his candle power, and if, for any reason, the temperatures in the purifiers did fall, he would condense sufficient tarry vapor to eventually injure the oxide. At any rate, the tar carried forward mechanically with the gas would be deposited in the purifier.

Mr. Prichard—Mr. President, I would be very glad to have this subject discussed a little more fully, because I would like if possible to learn something as to the relative merits of shaving scrubbers *vs.* what we call the P. & A. type. It seems that the shaving scrubbers are open to two quite serious objections. In the first place, there is the expense of changing the material, which is considerable, even if we burn it up afterwards and get value back for the shavings put in. There is another bad effect that has come about in our experience in using shaving scrubbers, if you make gas intermittently. It seems to me the deposition of tar on those layers of shavings is not removed as it is in the P. & A. type, and if you make gas intermittently there comes a time when that tar gets fairly cool, there is no gas passing through. Our experience is that the gas that passes after a period of rest has its candle power diminished quite perceptibly, so much so that a year or two ago we found it necessary to put heating coils under our shaving scrubbers to keep them up to a proper temperature. I have been gradually getting the belief that it would be better to abandon shaving scrubbers and put in the P. & A. type, providing some of our friends the manufacturers here have developed one that is all right, automatic and perfect.

Mr. Norcross—I just wish to remark, for the information of some who are evidently not aware of the fact, there is a paper on our programme by Dr. Beardsley which deals directly with the work of the tar extractor as compared with the shaving scrubber, and this subject will have to come up in detail later on.

Dr. Wing—In connection with Mr. Prichard's remarks I would like to call your attention again to the fact that the drainage which comes down from the shavings and out of the bottom of the scrubber is twice what the shavings increase in weight. A continual dripping is running from them. Of course, if they are saturated with moisture and put in service again after being out, but until they are warmed up again, they are a detriment to the candle power.

Mr. Kennedy—I don't know whether the thought is in order, but it seems to me now is the time to take up the paper dealing with that same subject. I feel, as Mr. Prichard does, it is of vital importance to know which is the better proposition.

The President—Unless there is some objection we will have Mr. Beardsley's paper, if it is ready. The discussion then can be continued in connection with both. [On motion of Mr. Anderson, seconded, a vote of thanks was passed to Dr. Wing for his paper.]

The President here introduced Dr. A. P. Beardsley (New Haven Conn.), who read the following paper concerning

DATA ON THE REMOVAL OF TAR FROM WATER GAS.

The removal of tar is one of the difficult problems in the manufacture of water gas. On the manner in which it is accomplished will largely depend the candle power results obtained; and, on the thoroughness of removal, the satisfactory working of the purifiers. The tests described in this paper were made in an effort to learn what part in the removal of tar is played by each of the pieces of apparatus through which the gas passes. In order that the bearing of the results may be better understood, a short description of the apparatus in use is first given.

The water gas plant at New Haven comprises three 8-foot, 6-inch and one 12-foot standard U. G. I. sets, all provided with air and steam meters and with pyrometers. The gas from the superheater passes through the usual wash-box and board scrubber, leaving the latter at a temperature a little over 160°. It is taken to the water tube condenser, through 310 feet of 30-inch steel main, which runs in the open almost all the way, and serves very effectively to cool the gas.

The condenser is of rectangular section, 5 feet 3 inches wide, by 42 feet 6 inches long, and 11 feet high between headers. It is rated at 3,500,000 cubic feet daily capacity. The gas travels horizontally while the water passes up and down vertical tubes in a general direction opposite to the gas flow. The gas enters the condenser at 135° to 140° and leaves at 120° to 125°. A relief holder 100,000 cubic feet capacity is located on a spur on the outlet main of the condenser. Being small and receiving only a portion of the gas made, it has comparatively little condensing effect. From the exhauster, which is next in series, the gas goes to the P. & A. extractor. This has a diameter of 5 feet and a rated capacity of 5,750,000 cubic feet daily. The temperature here is maintained at about 110°.

Following the P. & A. are 2 shaving scrubbers, connected in parallel, each 8 feet 6 inches in diameter, by 23 feet 6 inches high. Their combined capacity is 2 million cubic feet daily. At this flow, the speed of the gas through them, neglecting the space taken by the shavings, is 12.24 feet per minute. The outlet gas temperature averages 100°.

Last come 4 purifiers, 20 feet by 30 feet, by 10 feet deep. Each box has 3 layers of oxide through which the gas travels in parallel. With a daily make of 2,000,000 cubic feet, the speed of the gas through the oxide, neglecting the space occupied by the latter, is .77 foot per minute, and the time of contact 13 minutes. The gas leaves the purifiers at about 90°. The oil in use has a gravity of 30° B. The consumption is about 4.5 gallons per 1,000, and the candle power about 25.40.

In the apparatus above described, tar is removed from the gas in 5 stages: By the board scrubber; by the condensing system, taken as including everything from the board scrubber to the P. & A. extractor; by the shaving scrubbers; and by the purifiers. We have attempted to determine what percentage of the tar reaching each piece of apparatus is removed therein. The methods employed are described in an appendix to this paper.

It should be understood that the figures given, which were but very recently obtained, represent conditions as they at present exist, rather than as we would, in some cases, like to have them. The purpose of making these tests is to learn the present effectiveness and best method of operation of each piece of apparatus, and to give us knowledge necessary to secure improved results in the future. The data to follow are arranged in tabular form for each of the 5 stages of tar removal.

According to these figures, 14.2 per cent. by volume of the oil used has become tar. The undecomposed steam leaving the generator amounts to 8.03 pounds per 1,000. The board scrubber produces a

A.—*Board Scrubber.*

	At Superheater Outlet			At Scrubber Outlet			
	Oil per M.	Temp. base of Sheater.	Lbs. Tar per M.	Lbs. Water per M.	Lbs. Tar per M.	Lbs. Water per M.	Temp. of Gas	Per Cent. Tar Removed.
1	4.76	1,300	5.99	7.40	5.31	11.66	160	11.4
2	4.80	1,400	5.03	7.83	3.80	10.87	160	24.4
3	4.80	1,400	6.35	8.85	4.56	10.27	160	28.1
	4.79	1,366	5.79	8.03	4.56	10.93	160	21.3

sudden and great fall of temperature of the gas, largely at the expense of evaporating 2.9 pounds of water per 1,000, but it does not appear to be very effective as a tar extractor, since it removes only a little over one-fifth of the tar entering it. This allowance must be made, however. The quantities of tar given in the table above are the total quantities which separated out of the gas when cooled to 90° in the test. This temperature, which is that of the purifiers, was chosen partly to learn the total amount of tar removed from the gas by the whole system of tar extraction, and partly because of serious practical difficulties in estimating the tar at the temperature of 160° which the gas possessed when leaving the board scrubber. At this high temperature a considerable portion of tar is still present as vapor, and this portion the board scrubber cannot remove.

It is possible that the chief cause of the trouble in tar removal—namely, the formation of a very fine fog of tar—may be found here, in the too sudden cooling which the gas experiences in the board scrubber. Fog is formed when a gas containing the vapor of a liquid is cooled below the dew point or saturation point of that vapor. If the cooling is gradual, the particles first formed gather to themselves the additional liquid which condenses out as the temperature continues to fall; or, in other words, they become nuclei for the formation of larger particles. Thus drops are formed of sufficient weight to fall out themselves or to be readily removed by mechanical means. If, however, the drop in temperature is very sudden, there is a general and instantaneous formation of minute particles of liquid, so fine as to be easily carried in suspension by the gas, and to resist removal by the usual methods, which depend on the impact of these particles against surfaces presented. If the cooling of the hot gas were made more gradual, it seems possible that the formation of much troublesome fine fog might be avoided.

B.—*The Condensing System.*

	Board Scrubber Outlet			P. & A. Inlet		
	Lbs. Tar per M.	Temp. of Gas.	Make per 24 Hours.	Lbs. Tar per M.	Temp. of Gas	Per Cent. Tar Removed.
1	5.31	160	3,500,000	.58	106	89.1
2	3.80	160	1,100,000	1.17	100	69.2
3	4.56	160	1,100,000	.92	97	79.8
	4.56	160	.....	.89	101	79.4

To correspond with the conditions of test at the board scrubber outlet described previously, the determinations at the P. & A. inlet were made at 90° instead of at the temperature of the gas, as was the case in the three following tables C, D and E. The figures, therefore, represent a certain amount of condensed tar vapor as well as tar fog.

More tar is taken out in the condensing system than in all the other processes combined, the amount, according to the above figures, being 80 per cent. of that entering the condensing system, or 63 per cent. of the total tar made. Other tests of the quantity of tar present at the inlet of the P. & A. extractor indicate that this figure of 80 per cent. should probably be increased to 85 per cent. There is still left, however, from 12 to 15 per cent. of the original amount to be removed.

C.—*The Pelouze and Audouin Extractor.*

	Inlet			Outlet			
	Lbs. Tar Fog per M.	Temp. of Gas.	Make per 24 Hours.	Differential Pres.	Lbs. Tar Fog per M.	Temp. of Gas.	Pr. Ct. Tar Removed.
1	.458	89	1,100,000	2 inch.	.144	86	68.6
2	.434	90	1,100,000	2 "	.147	86	66 2
3	.400	108	3,500,000	4 "	.106	104	73.5
4	.355	108	2,400,000	4 "	.082	104	76.9
5	.487	112	3,500,000	8 "	.086	110	82.3
6	.695	96	3,500,000	8 "	.138	86	80.1

With a very large quantity of tar in the gas we have obtained an efficiency of 92 per cent. from the P. & A. extractor, but such a condition is unusual. The influence of the differential pressure on the results is quite marked. A change from 2 inches to 8 inches causes a rise of efficiency from 67 per cent. to 81 per cent. It is necessary that the difference of pressure should be kept both high and constant. Our usual difference has been about 6 inches, at which the extractor removes about 80 per cent. of the tar which reaches it.

D.—*The Shaving Scrubbers.*

	P. & A. Outlet			Shaving Scrubber Outlet			
	Ounces Tar Fog per M.	Temp. of Gas.	Make per 24 Hours.	Time in Passing Scrubbers.	Ounces Tar Fog per M.	Temp. of Gas.	Per Cent. Tar Removed.
1	.765	120	2,200,000	2.0 min.	.083	100	89.2
2	1.654	110	2,200,000	2.0 "	.219	96	86.8
3	1.446	108	2,200,000	2.0 "	.166	102	88.5
4	2.670	128	3,500,000	1.25 "	1.185	118	55.6
5	1.640	94	3,500,000	1.25 "	.758	90	53.8
6	2.540	100	3,500,000	1.25 "	1.206	98	52.5
7	2.229	104	3,500,000	1.25 "	1.083	100	51.4

It will be noticed that the scrubbers perform the fairly satisfactory work of removing 88 per cent. of the tar coming to them, when the flow of gas is about their rated capacity of 2,000,000 cubic feet daily. But their efficiency falls off with an increased make till it is only 53 per cent. when the rate of flow is 3,500,000 daily. Apparently a certain time of contact with the shavings is necessary, and this must not be less than 2 minutes. In calculating this figure no allowance was made for the space occupied by the shavings. The actual time of contact is, therefore, less than the apparent.

Both the P. & A. extractor and the shaving scrubbers act as mechanical removers of tar fog and a comparison is natural of the costs of removing tar by the two systems. In the first place, the space needed is far different. On the basis of maximum rated daily capacity, the extractor, including connections, occupies 21 square feet and 430 cubic feet of space per million feet of gas treated. The corresponding figures for the shaving scrubbers are 148 square feet and 5,624 cubic feet. The size of the last figure is partly due to the height required for the apparatus used in filling the scrubbers with shavings. On the same basis of gas treated, the costs of installation are in favor of the P. & A. extractor in the ratio of 1 to 6.6.

Yet it seems doubtful whether the work of the shaving scrubbers could be as well done by an additional extractor. The removal of tar fog in the P. & A. is due principally to the momentum given the tar particles by their velocity, which causes them to impinge on the baffle plates of the apparatus. The very fine particles may not receive the necessary momentum, and there will be left a certain amount of very fine fog, for the removal of which shaving scrubbers are necessary. How complete the filtering action of the scrubbers, if it may be so called, can be made, is indicated by the figures obtained for the purifiers, which are given below. The same sort of filtering action takes place in the purifiers, as in the shaving scrubbers.

E.—*The Purifiers.*

	Inlet			Outlet			
	Ounces Tar Fog. per M.	Temp. of Gas.	Make per 24 Hours.	Time in Passing Oxide.	Ounces Tar Fog per M.	Temp. of Gas.	Per Cent. Tar Removed
1	2.303	119	3,500,000	7.4 min.	.032	90	98.6
2	2.783	90	3,500,000	7.4 "	.067	97	97.6
3	2.508	112	3,500,000	7.4 "	.035	96	98.6
4	1.242	97	3,500,000	7.4 "	.032	93	97.4
5	.529	80	2,400.000	10.8 "	.010	83	98.0
6	1.252	82	3,500,000	7.4 "	.025	90	98.0
7	1.160	105	3,500,000	7.4 "	.028	92	97.6
							98.0

The time of passage through the oxide is figured without regard to the space occupied by the latter. The actual time of contact is, therefore, less. In the first three cases above, there was, for some unknown reason, an extremely large quantity of tar in the entering gas. Yet the purifiers removed it practically all. This is, of course, bad for the purifiers, but interesting as showing how effective the filtering out of tar fog may be made.

The writer is aware that there are inconsistencies in the results given in this paper. For example, the individual determinations which compose Tables A and B, do not check closely. The quantity of tar present at any given point varies from time to time. For some of these irregularities, we can assign reasons; for others, at present, not.

The determinations at the inlet and outlet of a piece of apparatus were always made simultaneously and with much care. It appears fair to assume that the results in the main indicate actual conditions. We hope that they are going to prove of value to us in improving our methods of operation, and that they will be of interest to those to whom this paper is addressed.

The greater part of the experimental work here recorded was performed by the writer's assistant, Mr. E. C. Dunham, to whose accuracy and care the results obtained owe their value.

APPENDIX.—METHOD OF DETERMINING TAR IN GAS.

A. *Sampling.*—To avoid error from the tar which lines the inside of mains, we have taken our samples through a piece of ¼-inch pipe, inserted half-way across the main. A pet cock has been attached to this as close to the main as fittings would allow, and in some cases the exposed parts have been lagged with asbestos.

B. *Method.*—The common method of determining tar in gas is by passing the gas through a tube filled with closely packed cotton. While all the tar fog is thus removed, the method is open to the objection that water fog is also caught, and the amount of the latter will usually be as much or more than that of the tar. To overcome this trouble, W. Feld has devised a clever method, which is described in the "Journal of the Society of Chemical Industry," February 15, 1911, p. 121. A large water bath (in our case a 10 gallon galvanized waste can) is fitted with a tube for gas supply through its side. A weighed tube packed with cotton is placed in the can, and connected on one side to the gas inlet tube, on the other to a meter. The can is set against the main, and a connection as short as possible made to the gas cock. If the room is cold, the connecting tube is covered with asbestos. The can is filled with water which is maintained at the same temperature as the gas in the main, and the required amount of gas is passed through the cotton tube. Tar and water will be caught.

Then a fresh cotton tube is connected inside the water bath to the gas supply and to this cotton tube is joined one filled with fused calcium chloride. The original cotton tube is placed third in series, and the gas passed through again. Tar and water fog are removed by the first cotton tube, and water vapor by the calcium chloride tube. The gas reaching the third or original cotton tube is, therefore, able to evaporate the water from it, but does not take up any tar oils, being already saturated with tar vapor at the temperature in question. A few trials will determine how much gas must be passed to bring the original cotton tube to constant weight. The simplest method of fitting up is to have two outlets through the sides of the water bath, with the chain of tubes connected between them in the order named. Passing the gas in one direction charges the weighed tube, and reversing the flow of gas dries it. By this method the error due to the absorption of water is avoided, as well as the very large error due to the additional condensation of hydrocarbon vapors, which would occur if the cotton tube were colder than the main.

The bulk of our tests on the P. & A. extractor, the shaving scrubbers and the purifiers was done by this method. It is evidently unsuited for gas which has not been condensed, however, and for such tests we devised the following method.

An upright spiral condenser was made of 7 feet of ¼-inch copper tubing. The lower end of this was connected to a side opening near the bottom of an upright glass tube of 1¼-inches diameter and 12 inches height. The condensed liquid gathers in the bottom of the glass tube. Above the side connection the tube was closely packed with cotton. After weighing the whole on a delicate balance it was immersed in a large water bath at about 90° temperature. The temperature was chosen as being that of the purifier outlet, and the lowest to which the gas is subjected while in contact with tar.

The hot gas is passed through and metered at the outlet. Both liquid tar and tar fog are caught, and the whole apparatus is weighed after the necessary amount of gas has been passed. It is connected to a weighed calcium chloride tube of good size and the whole immersed in a water bath which is brought to boiling. Gas or air, dried by passing through a calcium chloride jar, is led through the apparatus at a rate of about 1 foot an hour. All the water is carried forward into the calcium chloride tube and is there caught. Tar vapor, which is also taken up by the gas, passes through uncondensed, because the absorption tube is at the same temperature as the cotton tube.

A final weighing of the calcium chloride tube gives the amount of water obtained. The amount of tar is found by subtracting the water from the total increase in weight of the coil and cotton tube. When the amount of water originally condensed is large, the greater part can be filtered free from tar through a filter paper and weighed direct. The wet filter paper is, of course, at once placed in the cotton tube for drying. For gas which has been condensed, we have also used a cotton tube alone, placed in a water bath of the same temperature as the main. The water absorbed is determined in the manner just described and the tar found by difference. We rather prefer this to the Feld method, as being easier of manipulation.

Discussion.

The President—Gentlemen, you have listened to the reading of a most interesting paper by Dr. Beardsley. He expects you to discuss it freely. Don't disappoint him. Gentlemen, someone should start the ball rolling. Mr. Prichard, does this paper help you in any way?

Mr. Prichard—This paper is a complete answer to my question. I feel a little stupid at having raised the question and not having looked through the possibilities of the papers. The point occurred to me, as he was reading along, when I realized the necessity of increasing the differential on the P. & A. from 2 inches to 8 inches, as to whether the cost of that rise of pressure might not in a long way offset the advantages of the P. & A. over the shaving scrubber. The cost of increasing the pressure of 1 or 2 millions feet of gas a day from 2 inches to 8 inches must amount to something. I have not anything in mind that would throw any light on it, but it seems to me it must cost some money to pump that up.

The President—Is Mr. De Hart in the room? Could you give us some figures in answer to Mr. Prichard's inquiry about the gas?

Mr. De Hart—I am afraid I can't offhand; no. I am sorry to say that I did not hear all of the paper; I should very much like to have done so. I had not seen it beforehand, either. The expansion of water gas tar is a very interesting subject to me. We have always felt that the shaving scrubber was an absolute necessity, and that the P. & A. was a help to it. I judge from the last paragraphs of the paper that is about the conclusion Mr. Beardsley reached. The P. & A. will certainly take out a large volume of tar and relieve the labor of changing the shaving scrubber. In a large installation it pays.

The President—Has Mr. Ramsburg secured the information he was looking for?

Mr. Ramsburg—If I may be permitted to approach this subject gradually, I would like, first, to ask Mr. Beardsley if the relief holder in this plant is on a spur connection?

Mr. Beardsley—Yes; it is so stated.

Mr. Ramsburg—I did not notice it; but I see now that you have mentioned it. So far as the condition which Mr. Beardsley desires, of allowing the gas to condense quietly and accumulate the drops as much as possible, this plant is not exactly as the ordinary water gas plant is operated; in other words, with these temperatures which he has at New Haven, if the gas has been allowed to pass (first) into a relief holder, where the gas might remain in a quiescent state for perhaps an hour (in other words, the average time of the gas in the relief holder would be 1 hour), the amount of tarry vapor in the gas when it came to the P. & A. extractor, and the state of the vapor, would be very different from what it is here. I also note he runs the tar extractor at 110°. I think that 105° is better than 110°, and the difference between 105 and each degree over that on the efficiency of the extractor is very marked. Is other words, above that point there is considerable vapor in the gas, not in the form of mist, which is allowed to get through the extractor and which comes down as the dew point of the gas is lowered, it will militate against the test of the extractor if at 110° there still remains in the gas some of the tar in the form of gas. I noted that Mr. Beardsley has used the method I attempted to describe of getting an accurate test of the amount of vapor removed. I regard this paper as a very high class paper. Only one point that I would like to bring out is that I think the tar extractor drum used on this test is not of the most recent type. A more recent type than this gives an efficiency of between 95 and 97 per cent. over the 80 per cent. which the old extractor drum gave. This new drum was originated by Mr. Glasgow, in England. It is being tested out thoroughly at the present time, and has been put in some plants, and in Philadelphia we are getting very excellent results on it. I hope it will keep going. In reference to the question as to the increased cost of pumping, due to the increased pressure on the P. & A., the amount of steam to be used in pumping of course is in direct ratio to the pressure. Consequently an increase of 4 inches, for instance, in the initial pressure of the gas on the extractor, would increase the amount of steam to be used that proportion of the pressure. It would not amount to very much. An increase of 4 inches, pumping 1,000 feet per minute against a head of 16 inches, would be 7 horse power, or an increase in cost of 2 cents per horse power of about 34 cents per day.

Mr. Kennedy—Mr. Ramsburg is doubtless in touch with Mr. Glasgow's work. I would like to know whether he has any idea as to the relative values of the so-called cyclone tar extractor for water gas purposes as rated against the P & A., or as coming in series with it, prior to it.

Mr. Ramsburg—I saw one of those cyclone extractors in operation at Manchester, England, about a year ago, but the temperature at which it was being operated was so low that it was impossible to get any conception as to a comparison between that and our apparatus. I am afraid I can't give you any comparison on that. It is rated very high in England, I understand.

Mr. Kennedy—I was wondering whether the burden that it would take from the general condensation would increase the efficiency of a P. & A. following it.

Mr. Ramsburg—I should think it would, but I can't give you figures on it.

The President—Is there anything more to be said on this paper?

On motion of Vice-President Barnum a vote of thanks was given Dr. Beardsley for his excellent paper.

(To be Continued.)

[Continued from Page 209.]

PROCEEDINGS, SIXTH ANNUAL MEETING, AMERICAN GAS INSTITUTE.

Held in St. Louis, Mo., October 18 to 20, 1911.

Second Day—Morning Session.—Section A.

The President said he understood the report of the Committee on Thermal Value was a very short one, (the Report of the Calorimetry Committee was read yesterday), which he wished would be discussed at this meeting if possible. He would call for that report, and it was the final number on their programme.

REPORT OF COMMITTEE ON THERMAL VALUE AND CANDLE POWER.

The report of this Committee was made by its Chairman, Dr. Alexander C. Humphreys, as follows:

Your Committee is not prepared at this time to make any definite recommendation, in view of the experimental work now under way in America and foreign countries. Further time should be allowed for the investigation of the important questions involved in the testing of thermal valves and candle power of gases of varying composition. Your Committee, however, wishes to endorse the several recommendations contained in Mr. C. O. Bond's paper just presented, as follows:

1. That this Institute promptly appoint 3 delegates to the International Photometric Commission, these delegates to be prepared to undertake individual investigations, to be reported to the next Congress of this Commission, in 1913, the officers of this Institute to notify the President of the Commission of the appointment of the Institute's delegates, so that they may be assigned to such investigations as may be considered advisable by the President of the Commission. The Institute's delegates to report progress to said Institute at its next convention.

2. That the Secretary of the Institute be instructed to prepare a report of the "Proceedings" of the sessions of the International Photometric Commissions thus far held, this report to be incorporated in the "Proceedings" of this Institute, preferably in the next volume.

3. That the Technical Committee of this Institute be instructed to confer with the National Bureau of Standards as to the adoption of a standard test burner or burners to be employed in determining the illuminating quality of gases.

4. In accordance with the communication from the Director of the Bureau of Standards to the Secretary of the Institute, your Committee strongly recommends that the members of this Institute submit their pentane lamps to the Bureau of Standards for certification.

Your Committee notes with pleasure that Mr. Bond is willing to submit a paper at the Institute's next convention on the photometry of incandescent gas lamps. Respectfully submitted,

J. M. Morehead,
R. M. Searle,
W. H. Gartley,
J. B. Klumpp,
Alex. C. Humphreys, } Committee.

[On motion the report was adopted.]

On motion of Mr. W. S. Blauvelt it was ordered that the Institute appoint a Committee to establish standard methods for carbonization tests of coal.

A Resolution.

Mr. Humphreys prefaced the following motion by remarking that they did not conduct their meetings to the best advantage.

Resolved, That the officers of the Institute be requested to consider the several means that might be adopted to increase the efficiency of our meetings, and especially to consider the advisability of requiring papers to be filed with the Secretary a sufficient time in advance of the meeting to permit the printing of papers and distribution to the members of the Institute, residing in the United States, at least two weeks in advance of meeting. The papers then to be read by title, supplemented by 10 minutes' time, to be allotted to the author to enable him to emphasize the essential points of his paper, preferably by a written abstract. Papers not filed with Secretary within the time given not to be accepted.

The resolution was put and declared adopted, and the sessions were declared adjourned to 2 P.M.

Second Day, Thursday, Oct. 19, 1912.—Section B.

Section B, of the Institute met in the lower hall of the Art Building, at 10 A.M., Mr. W. C. Morris presiding. The Chairman introduced Dr. L. C. Loewenstein, who read his paper on

THE CENTRIFUGAL COMPRESSOR IN THE MANUFACTURE OF GAS.

In manufacturing gas it is necessary to supply a proper amount of air during the process of gas making, and to compress the gas into gas holders or gas mains after the gas has been manufactured. For both of these purposes some form of air compressor is necessary. The object of this paper is, first, to call attention to a somewhat recent development of improved air compressor which has, among other advantages, a much higher efficiency than any similar apparatus used heretofore; and, second, to describe a comparatively new method of controlling the air supply to gas apparatus securing thereby an increased and more uniform output.

The rapid substitution of rotating for reciprocating machinery has been one of the most striking engineering developments of recent years. The marked success of the steam turbine no doubt stimulated the development and introduction of the centrifugal pump, and more recently the centrifugal compressor, so that we can say the centrifugal compressor to-day stands in the same relation to other air compressors as the steam turbine stood 15 years ago to the reciprocating engine, or as the centrifugal pump stood 5 years ago to former pumping apparatus.

Centrifugal compressors can be built, either as single-stage or as multi-stage units, and are usually direct-connected to prime movers, preferably steam turbines or electric motors, because the centrifugal compressor is necessarily a high speed mechanism. A single-stage centrifugal compressor consists solely of a revolving impeller surrounded by a stationary set of discharge vanes supported in a suitable casing. A multi-stage compressor consists of 2 or more single-stage units mounted on the same shaft and operating in series within a common casing. Fig. 1 shows an impeller, a set of discharge vanes,

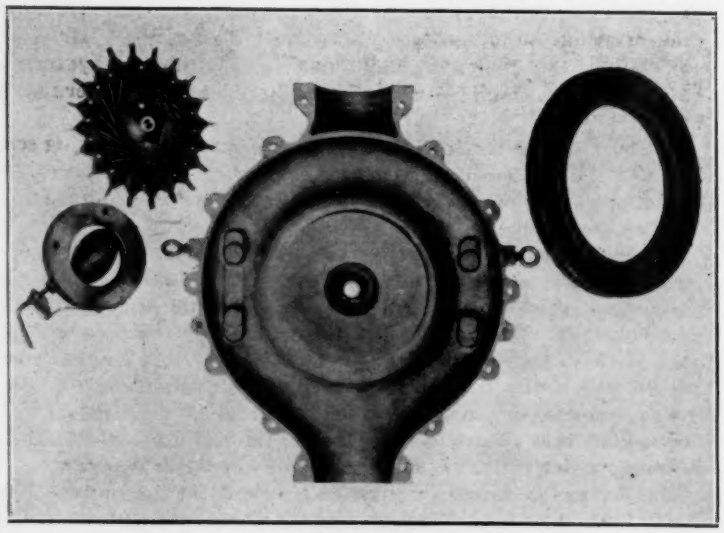


Fig. 1.

a half casing and a blast gate of a single-stage compressor. When set revolving, the impeller will, by centrifugal force, entrain a fluid, say air, at its inner periphery and will discharge it at its outer periphery at an increased pressure. This resultant pressure can be called centrifugal pressure. Besides this, the impeller has set the air into motion, and at the outer periphery (or discharge end) of the impeller the air is moving at practically the same velocity as the peripheral speed of the impeller. This velocity amounts to hundreds of feet a second, and of course, represents a large amount of energy expended by the driver. It is the function of the stationary set of discharge vanes to convert this energy in the form of high velocity into pressure energy. The discharge vanes are so designed that the air in passing through the passages between the vanes is gradually reduced in speed and the energy recovered in the form of an increase of pressure. Taking, for instance, any one of the centrifugal compressors illustrated in this paper we may say that possibly 90 to 95 per cent. of the energy supplied by the driver to the compressor appears in two forms of energy in the air as it leaves the rotating impeller. Roughly speaking about ¼ the available energy exists in the form of

centrifugal pressure, and ½ exists in the form of velocity. In an ordinary fan or blower this high velocity air is allowed to dissipate itself into eddy currents and finally exists in the air in the form of heat. In a centrifugal compressor this energy is largely recovered in the form of increased pressure. Hence, the vital difference between an ordinary fan or blower and a centrifugal compressor, lies in the fact that the former has no discharge vanes and, therefore, does not recover any of the velocity energy generated by the rotating impeller, whereas the latter has discharge vanes which recover the larger part of the velocity energy produced by the impeller. It can be readily seen why the centrifugal compressor is so highly efficient, and why this recent development of air compressor is replacing former existing types. It means that, for compressing the same amount of air against any definite pressure, the centrifugal compressor requires much less power, hence a much smaller motor or driver than used heretofore. There are also other advantages worth considering. On account of being able to operate at high speeds this compressor is much smaller in size than any other compressor delivering the same work; and, further, because it can run at high speeds, it can take advantage of being direct connected to high speed drivers, which are in themselves smaller and more efficient than those which must operate at low speeds. The moving parts of a centrifugal compressor consist only of an impeller mounted on a shaft and supported in bearings. There are ample clearances about the impeller, and if the bearings are properly designed, and provided with efficient lubrica tion, there are no rubbing parts whatsoever, hence the original efficiency of the unit is maintained after years of service. Compare this to the performance of displacement or positive pressure blowers where frequent renewals are necessary to maintain somewhere near the original efficiency and output, or compare this compressor to the inefficient and large fans or blowers heretofore used, and it does not then seem too optimistic to predict in the near future the entire substitution of centrifugal compressors for all other forms of air com pressors.

Although the initial development of this new type of compressor was first begun in Europe, the General Electric Company started, about 3 or 4 years ago, to develop and introduce the centrifugal compressor in this country, and in this comparatively short space of time the General Electric Company was able, not only to build compressors of equal and higher efficiencies than those produced abroad, but had advanced the art of building the largest units that have ever been attempted anywhere. The following illustrations show the general appearance of some of the standard, single-stage compressors built by this Company.

Fig. 2 gives a photographic view of a turbine-driven, centrifugal

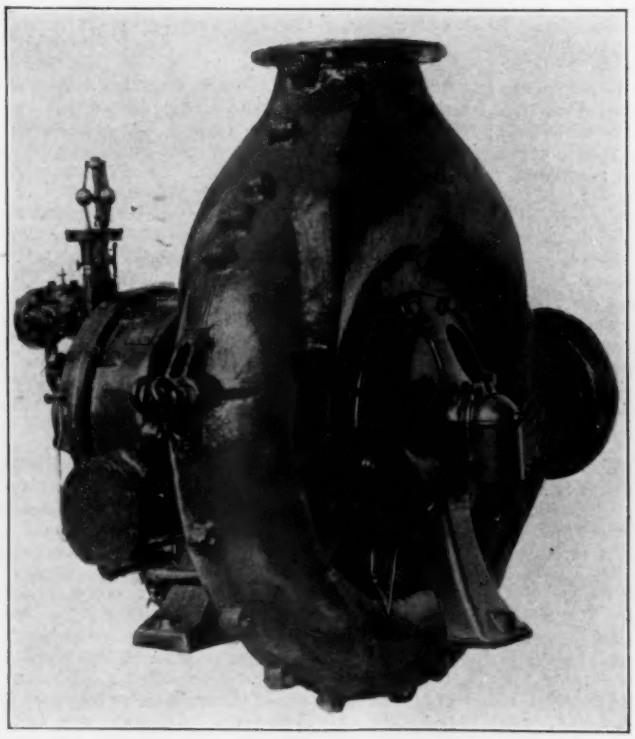


Fig 2.

compressor, capable of delivering 10,200 cubic feet of air per minute against 1 pound pressure. It is direct connected to a Curtis steam turbine, running at a normal speed of 3,450 revolutions per minute. This set was furnished to the Springfield (Mass.) Gas Light Company. As can be seen, the entire unit has only 2 bearings, the compressor impeller being supported between the 2 bearings, and the turbine wheels being overhung at one end. As the pressure delivered by a centrifugal compressor is directly proportional to the speed of the impeller, practically constant pressure is maintained, no matter what the volume of discharge, if the turbine is kept running at constant speed. In order to change the pressure delivered by the set, the turbine can be speeded up or down so that this piece of apparatus can be said to force the air or gas against a constant resistance or pressure no matter how varying the quantity demanded.

Fig. 3 shows another centrifugal compressor, direct-connected to a

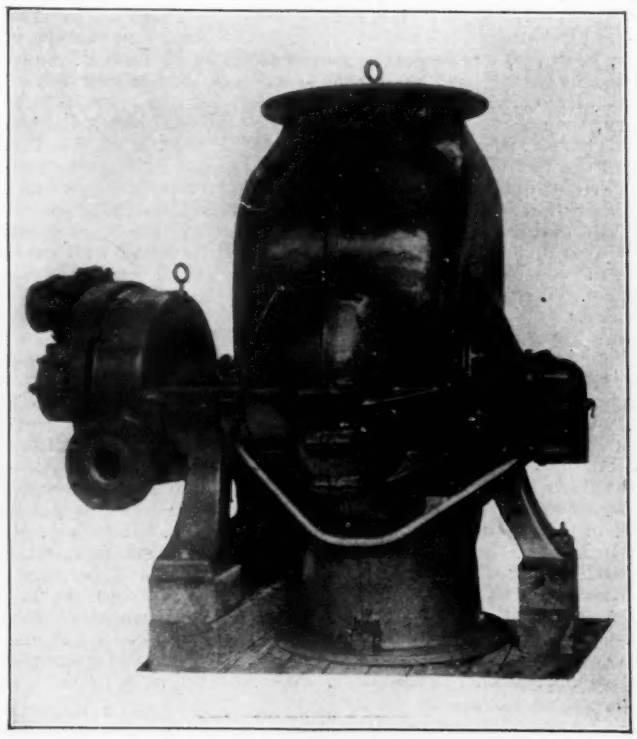


Fig. 3.

steam turbine, and capable of delivering, in this case, 4,200 cubic feet of air per minute against 2 pounds pressure. This set also runs normally at 3,450 revolutions, and was furnished to the United Gas Improvement Company, of Philadelphia, Pa. In general design it is similar to the previous set, the only changes being that the air intake

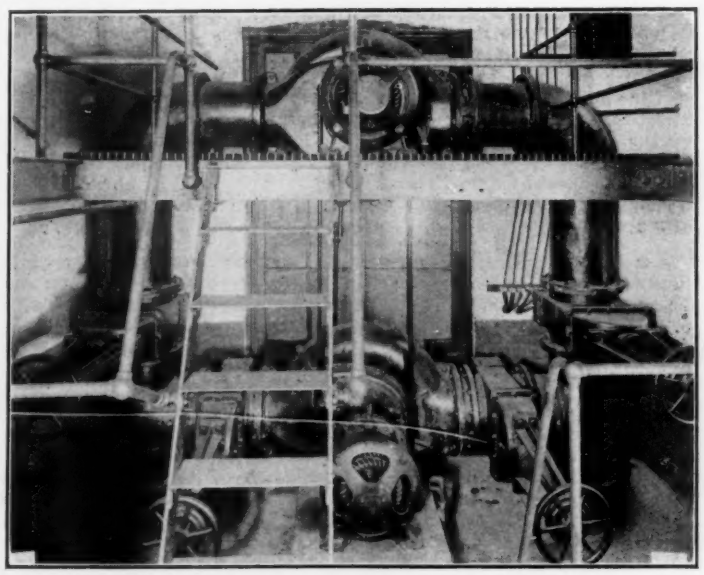


Fig. 4.

and air discharge are set at 90° to each other, instead of being opposite, as in the previous figure.

Fig. 4 shows 2 centrifugal compressors driven by induction motors, furnished to the New Amsterdam Gas Company, New York City,

(*Continued on page* 208.)

[Special Editorial Correspondence, by Telegraph.]

EIGHTH MEETING, ILLINOIS GAS ASSOCIATION.

AUDITORIUM HOTEL, CHICAGO, ILLS., March 21, 1912.

This year the Sun had a hard voyage of it crossing the line, at any rate in and about this bouncing city's confines; that is, if it is ever to have "confines" other than the great lake, which of a certainty often fans it violently. Those who know what is meant when it is declared that a really violent gale from the northwest is on, and that the chief business of the gale is to drive into every possible recess a pack of snow that is not of the direct type, know that we are having it "good and plenty." Without a word of doubt respecting the information, even the clever managers of this world-famed hotel were at their wits end to warm its chambers; even the meeting place in the handsome assembly room on the "6th landing" was much to the cold. President Strohn called the assemblage to order at 10 A.M., of yesterday. Possibly not over 50 greeted the call, but when business was underway—say at 11 A.M.—those who came in on belated ways brought the attendance to 100. President Strohn and Secretary Newbury, however, were equal to keeping things in motion, and while one might be inclined to complain of the temperature none could justly utter criticism unfavorable to their activity. In fact the Secretary, despite his "newness on the job," proved himself just the man for its perplexities. Routine business, the reports of the Directors and of the Secretary-Treasurer included as the outstart, showed that the spirit which caused the Society's formation 8 years ago was active to the point of buoyancy and that united effort, harmonious counselling and mature action were still safely guiding the Association over the course that had been mapped out for it by those who created it. With the routine out-of-the-way President Strohn read his inaugural message. While it is true that it was not a lengthy document, nevertheless its side-lines carry much that could be studied to the point of causing the student to see things in a light which could chase more than one shadow of distrust from his pathway—from unreasoning distrust of State Commissions, for instance. The balloting for new members resulted in the placing of 23 active and 4 associates on the lists, which really represents a 12 per cent. increase. The first paper to occupy attention was that by Mr. Geo. F. Goodnow, whose theme was "Some Observations Regarding Gas Ovens in Europe and America." Unfortunately the author was not present, and the reading of the paper was given over to the President. This absence was regrettable, in that it cut the discussion considerably. However, Mr. W. E. Hartman, of the Koppers' concern, presented some facts and figures that will be closely scanned by gas men in general when this paper appears in full in public print. In the second set number Mr. C. J. Bacon described "Some Methods of Coke Dust Disposal," which recital was not followed by a discussion of the sort which the merits of the communication seemed to warrant. A well put together lecture on "Co-Operation," by Mr. W. L Powers, brought us to the luncheon hour.

AFTERNOON SESSION.

Not a minute was wasted in getting down to the start for the afternoon. The opening paper was that by Mr. C. A. Luther, of the Peoples Company, of Chicago, and his subject had to do with the "Illumination of the Peoples Gas Building in Chicago." As the author had quite a bit to do with this work when it was being carried on, he naturally spoke by the plan, his speech being interesting and instructive. Its presentation was greatly affected (and to the good) by the clever use of many excellent lantern slides. The scholarly paper, respecting "Volumetric Changes that Occur in Measuring Films in the Transition of Same at Time of Test Through Gas Meters that Have Been in Service," by Mr. C. C. Schiller, caused quite a bit of debate, some of which, however, was rather well out of the lines intended. In other words, that it resembled a delving not in the ways of straight furrowing. Mr. Edward Curry's clever presentation of "Getting New Business" was the last regular number for the day, and he had the satisfaction of knowing that the debate evoked was worth the while. Quite a telling report was handed in by the Special Committee charged with the task of pointing a way to accident prevention. The work was so well reported that the Committee was instructed to continue the studies for another year. .

It may be that storm raged without, and the external congregating spots of men were tenantless; but, let me say to you, 'twas not so in the Florentine Room of the Annex; well, any time after 7 P.M., or so. The banquet menu was well selected, the stewards had done well their purchasing, and the cooks had seen to it that their labors were rather those of willing zeal than of stilted non-endeavor. The toastmaster was Mr. John F. Parker—he does not weep as readily as Mr. Roper does—and he surely could not have been given an extra hard task, when it is remembered that at his command, were many of the smoothest tongued orators in the Illinois State. The first of the lot, though, to yours, was the appearance of Mr. Chas. H. Dickey, who, after long combat with illness, is his good self again. Mr. H. L. Hibbott, of the Engineering Staff of the Peoples Company, sang so well that if the auditors had their way, he would be warbling still; the Oxford quartette gave us all cause for joy; and Spencer's Orchestra didn't seem to mind the weather a bit. The attendance numbered 330, and if the jollity and fine cheer may have been close at times to the dinning point, was all the more enjoyable, when one inadvertently caught the sound of the howling that boomed directly out of the million-throated lake of Michigan.—W.

AUDITORIUM, CHICAGO, March 21, 1912.

You have all likely, somewhere or "somewhen," been confronted with changes that were as synonyms are to antonyms, as analysis is to synthesis, as yes is to no. Well, gusty old Chicago, this morning, as to yesterday morning, is as the day is to night; as sunshine is to shadow, as pleasure is to pain. Never a more glorious morning greeted anyone. A sun beamed that could not be denied as the advance agent of Spring, a temperature glowed that animated you, the Lake was as composed as though never in its waveful existence had it done harm to man or to his possessions. Yesterday, it was a pandemonium of nature; to-day it is nature, the beneficent. Promptly at 10 this morning, President Strohn (and let me here say that his conducting of this meeting was absolutely flawless) called for the regular order. A dozen or more belated applicants for membership were admitted, and an excellent report from the standing Committee on Public Relations was considered. Next was the report of the Nominating Committee, the recommendations from whom were accepted and the "recommended" were in short order declared officers for the ensuing year. The officer bearers chosen are:

President.—H. O. Channon, Quincy.
Vice-President.—Wm. F. Barrett, Chicago.
Treasurer and Secretary.—Horace H. Clark.
Representative to Am. Gas Inst.—C. B. Strohn.

The change in the Treasurer Secretaryship was an obligatory one, Mr. Newbury declining to continue in the dual office owing to inabilty to give to its duties a proper share of his time. His successor is a son of Mr. Jno. C. D. Clark, whose yeoman's work in connection with the development of the commercial division of the business of the Peoples Gas Light and Coke Company, of Chicago, is still *courant* in the minds of those who watched its giant striding under Mr. Clark's directing. The first paper to occupy attention was that by Mr. W. I. Battin, whose dilating on "Two Pounds Pressure at the Tip! Why Not?" was in that gentleman's best vein; and as a paper writer he has the undoubted ability, of so arranging his paragraphs that they are always sequential. The morning session was brought to a close following the reading of the paper on "Flow of Gas Formulae," by Mr. J. M. Spitzglass. If I mistake not this paper will be given wide attention later on.

The afternoon session was opened with a paper dealing on "The High Pressure Distribution System," by Mr. J. B. Hirst. The discussion of this topic clearly brought to light anew the fact that the success of high pressure work in Illinois had been so marked that Indiana was now engaged in following her sister State's example, with the result that even the farmers were to be possible users of artificial gas in their prairie homes. Next came an interesting communication on "The Liquid Purification of Illuminating Gas," from Mr. C. A. Schnerr. It is his first contribution to the literature of the profession, and it certainly is desirable, "now he knows the way," that he will speedily be heard from again. The regular list was closed by a very interesting paper on the "Application of Chemical Control to the Operation of Water Gas Apparatus," by Mr. W. G. Wallace. His well put together paragraphs were of a most useful order. The usual votes of thanks here brought to a close a meeting that was a notable one, even in the history of that virile body, The Illinois Gas Association.—W.

BRIEFLY TOLD.

ANNUAL MEETING, STAFF FORCES, U. G. I. COMPANY.—The 1912 meeting of the Superintendents, Engineers and Managers of the Company, and affiliated organizations, was called to order Tuesday, March 12th, at 10 A.M., First Vice-President, S. T. Bodine, in the Chair. After the opening address the regular order of business was taken up. The subjects discussed were in connection with the design and operation of plants; how to act when confronted by accidents; also, practices incidental to distribution; the proper handling of appliances; matters relating to new business, etc. Friday morning (the 15th inst.) a trip to the Welsbach factory at Gloucester, N. J., was made, where the different operations connected with the manufacture of Welsbach burners was thoroughly shown to the visitors. There was also a most interesting conversation on recent Welsbach developments, abetted with a demonstration of new appliances. On Saturday (the 16th) the visiting delegates, with a number of men from the Philadelphia home office, went to Atlantic City, N. J., in which famous resort the party enjoyed in fraternal fashion a day of intercommunion marked by formality, but fraught with reasonable entertainment. The return to Philadelphia was made last Monday. Not less than 80 delegates from the Company's outside stations shared in the outing, which was in every best sense an enjoyable one.

MARCH MEETING, PHILADELPHIA SECTION, ILLUMINATING ENGINEERING SOCIETY.—The regular monthly meeting of the Philadelphia Section, Illuminating Engineering Society, was held in the Assembly Room, 1000 Chestnut street, Philadelphia, Friday, March 15. The usual dinner preceding the meeting was held at Mosebach's restaurant, the attendance thereat being 58. The meeting was called to order by Mr. J. D. Israel, with 153 members and visitors in attendance. The Secretary read abstracts from the minutes of the General Council meeting, held in New York; also, of the New York and Chicago Section meetings. Prof. Rowland delivered the third of his series of "educational talks, which had for its titling "Shades and Redistribution of Light." The paper was illustrated by lantern slides and practical demonstrations. Dr. Herbert E. Ives, of Cleveland, O., read a paper on "The Application of Photography to Photometric Problems;" and Dr. Clayton A. Sharp gave an extemporaneous talk on "Some Casual Observations of European Lighting," which "talk" was copiously illustrated by lantern slides.

THE GAS "MEETERS."—The Seventh Meeting of the Gas Meeters was held in the Auditorium of the Public Service Company, Newark, N. J., the 18th inst., at 4 P.M. The topic of the day was "Indirect Lighting," several fixtures being on exhibition. The subject was opened by Mr. H. Thurston Owens, who sketched briefly the theory of direct, semi-indirect and indirect lighting, showing that, with the increasing interests in the latter forms, was but a logical outcome due to the greater efficiency and higher intrinsic brilliancy of our modern light sources. The practical side was then taken up by Messrs. C. B. Clark and W. W. Barnes, after which followed a general discussion actively conducted by Chairman W. H. Pettes and Messrs. S. K. Campbell, A. R. Burr, C. H. French, I. W. Peffly, J. P. Conroy, J. P. Hanlan, G. E. Smith and others. Shortly after 6 o'clock the members adjourned to the Hotel Achtel-Stetter for dinner, in which over 50 shared. Mr. I. W. Peffly presided. After dinner the lighter and, in some cases, the humorous, side was disposed of by Messrs. R. R. Young, J. M. Brock, F. D. Moses, Louis Stotz, Allen Booth and others.

MARCH MEETING, PROGRESS CLUB, BROOKLYN UNION GAS COMPANY.—The managers of this successful organization, composed principally of those connected with the meter and new business departments of the Brooklyn Union Gas Company, headed by Chairman Howard L. Denton, arranged for a lecture on "Illuminating Gases," which was delivered by Prof, Arthur C. Neish, of Columbia University, at 8:15 P.M., March 20, in the Club Rooms, Atlantic avenue, Brooklyn. The announcement of the lecture stated it would be "unusually interesting," and this promise was fulfilled in every sense. A miniature coal gas plant was in full operation, and, in addition, there were plentiful samples of natural gas, hydrogen gas, carbon monoxide gas, Pintsch gas, Blau gas, acetylene gas and a calcium light, for purposes of comparison, deduction, etc. The natural gas exhibit was in reality the vapors from liquefied natural gas, and it was said to be the first sample of the sort shown in New York city. The speaker, in describing the processes under which the beforementioned gases were manufactured, put forward much statistical data which indicated their relative standing and importance. In addition to the apparatus exhibited, there was displayed a rather complete chart, which showed for each kind of gas its specific gravity, calorific value, candle power, explosive limits, cost per 1,000 cubic feet, and cost per candle-hour. The attendance numbered 100 members, whose close following of the lecturer's text was well evidenced by frequent applause.

CURRENT MENTION—

AT a meeting of the United Gas Improvement Company, held in the home office the afternoon of the 15th inst., Mr. Thomas Dolan, President of the Company since February, 1892, resigned that position, having determined that an active business life of 60 years entitled him to a less strenuous mode of living. His record career in life really reads like the tales of the lamp, and in his 81st year—he celebrated his 80th birthday October 30th, 1911—he still retains the mental vigor that ever characterized his long and eventful life. The other changes wrought in this resignation as the Company's President—Mr. Dolan remains on the Board of Directors, of which body he has also been chosen Chairman—are these: First Vice-President Samuel T. Bodine becomes President; Mr. Randal Morgan goes to the office of First Vice-President; Mr. Walton Clark is Second Vice-President; and Mr. Lewis Lillie will act as Third Vice President; Mr. W. F. Douthirt, formerly Secretary, becomes Fourth Vice-President, and Mr. George W. Curran, heretofore the Company's Comptroller, will hereafter be its Secretary,

MR. ROBERT SHRIVER, Secretary-Treasurer of the Cumberland (Md.) Gas Light Company for many years, died at his home in that city, Monday, the 18th inst. He was in his 74th year.

Address of the President (Mr. C. B. Strohn) of the Illinois Gas Association, on the Occasion of the Eighth Meeting, Chicago, March 20 and 21.

Gentlemen: An address of this kind must necessarily present topics concerning which the writer cares most to arouse discussion, which topics may not be the ones most interesting to a majority; but it is difficult to select a subject that would hold the closest attention of every listener, owing to the several well defined branches of our business to-day.

Nearly every man engaged in the gas business familiarizes himself with the new ideas that are being advanced for improving the manufacture, distribution and sale of gas. While following this commendable practice, there is still danger that he will overlook the branch of our business that is most easily and rapidly affected by changes. I refer to our relations with the public, even though it is an old subject, and might cause the comment that it has been thoroughly dissected in years gone by; but this is a problem that can never be completely solved with definitely satisfactory conclusions. Fresh political and social differences occur from year to year, and it is the duty of every conscientious gas man to ask himself frequently whether or not he occupies the correct viewpoint relative to the public. In the words of a prominent member of the gas fraternity, "The wise manager he is who now gives his time and ability to a more careful consideration of the ethics of his profession, leaving many material matters to others for faithful furtherance."

It is, indeed, fortunate if any manager of a gas company is keen enough to see himself as others see him. This is not always possible, unless he has friends who are perfectly frank in their statements, and ready to tell him what he ought to know instead of what he would probably most like to hear. Quite often the man in charge of the operations of a company imagines that his manner of serving the public is satisfactory, but it is necessary, however, that he dispel all doubt on this point. He should be sure that the majority of his customers are satisfied with his methods, and whenever a campaign is opened for the cultivation of public goodwill, the start is made in the knowledge that a majority of the people is certain to be fair. If the service is good the majority will recognize it as such.

It would seem very poor policy to ignore a man's complaint, because, in the manager's opinion, he is what is called a "Chronic Kicker." If there is such a man on the list of customers, it is the manager's duty to reform him. This can be accomplished by the usual courtesy, abetted by tireless efforts to ultimately make right what the customer, in his own heart, imagines is wrong.

Every gas company engaged in developing new territory will encounter opposition from some of the citizens who have been born and raised there, and although the gas man has been familiar with the use of gas for cooking and lighting during the greater part of his life, he will hear much from men and women who never lighted a burner or a jet. He will hear that the stove he is selling is constructed to consume twice as much gas as the one sold by the local hardware men; that the franchise is for fuel gas only; that the meters are installed in the cellar to make them run faster; that the gas is twice as expensive as gasoline and four times as expensive as coal; that, at the end of a year, the company will raise the price of the gas—the price as stipulated in the franchise having nothing to do with the future desires of the company officials. The foregoing "arguments" are too petty to deserve the attention of the experienced, broad-minded manager, for he faces a problem more difficult than the one mentioned. In a crisis of this kind he must watch his workmen closely. Being loyal and full of fighting blood, they do not enjoy hearing these unfavorable stories about gas. It certainly requires a fund of patience and tact to cause men to assume the indifference that they should. Not being accustomed to self-restraint, it is much harder for them than it is for the man in charge. In a new territory it is very essential that ill feeling be overcome immediately, because in a period of one week it is possible for a gas company to acquire an unfavorable reputation that cannot be altered in years.

Employees who come into direct contact with customers should have proper qualifications. There is where the manager's skill is shown in selecting men to perform work for which they are adapted. There are many brilliant, successful men in the gas business who would fail hopelessly were they to be assigned duties that would bring them face-to-face with the public.

I believe that the subject of "Public Relations" has received too little attention in the past meetings of the various Gas Associations. We have been too busy working out improvements in manufacture, distribution, selling and accounting, to the almost entire overlooking of this most important psychological study of public relations. It is a subject that will stand thorough investigation, profiting by statistics, interviews with influential citizens, and conferences with fair-minded public officials.

It is my opinion that the number of State commissions for the control of public utilities will greatly increase; slowly at first, but more rapidly when they have demonstrated that their system of regulation is operated with undisputed skill and fairness. It has been possible for every gas man, who was interested, to follow the work of these commissions, because, as rapidly as possible, reports have been printed, and, on various occasions, papers have been read by members of the commissions. All reports and other literature bearing on this subject should occupy the most prominent place on every manager's desk. The commissions have a mailing list so that this valuable printed matter may be distributed in localities where it is most appreciated. In every community where gas is sold at least one customer is interested in the progress of the gas company's affairs. It is much better for the gas manager to enlighten such a customer on the subject of public utility commissions than it is for the customer to supply the manager with this information.

This Association is fortunate in having a Public Relations Committee, and an excellent report was rendered by this Committee at our meeting in the year 1911. The work was continued, and undoubtedly the report of the Special Committee on Standards, as provided by a resolution passed at our last meeting, will be most valuable and interesting.

In this communication I will remind everyone that no officer of this or any other gas association can urge too strongly the co-operation of its members. The successful advancement of the interests of an association becomes a gigantic task in the hands of a few willing workers; but a simple, pleasing pastime if the ones in charge know that 200 men stand back of them, ready to assist in any way should a request for assistance be made. Every man actively engaged in any one of the numerous branches of the gas business has his time fully occupied without taking up anything in addition to his regular duties; therefore, we should feel grateful toward the men who write these papers of great educational value, and toward the men who labor on the committees with but one thought in mind—the absolute success of the Association.

In conclusion, I thank every member for assisting in the work during the past year. I am under obligations to the other officers and committee members who have been wholly responsible for the preparation of a pleasing programme, which is certain to entertain and instruct us all.

(*Continued from p. 205.*)

each set being capable of delivering 3,600 cubic feet of air a minute against a pressure of 0.9 of a pound. This photographic view illustrates how conveniently these sets can be located and the small amount of floor space they require.

All the compressor sets described until now are units built to operate against a constant resistance of pressure, and are known as constant speed apparatus. There are cases in which the air should be delivered with constant volume against a continually varying resistance or pressure, and such class of apparatus is known as constant volume compressors. As far as the compressor is concerned, the constant volume unit is exactly the same as the constant pressure unit. The only thing necessary to change a constant pressure set into a constant volume set is to add the so-called constant volume governor, which automatically controls the speed of the driver, thus varying the pressure delivered by the unit and maintaining a constant volume of air delivered.

It is to this type of apparatus that I would like to call your particular attention, because of its excellent application in the manufacture of water gas. In this case the air should be delivered to the gas generator under constant volume, not under constant pressure, as is generally done. It may be interesting to analyze just why this air is needed and how it should be delivered in order to obtain most efficient operation. In the manufacture of water gas, the generator is filled with a deep fire of coal or coke, a blast of air is admitted in the bottom of the generator under the grate, and passes up through the fuel. The oxygen in the air unites with the heated carbon to form carbonic oxide. The nitrogen is not affected. These two gases, carbonic oxide and nitrogen, are termed the products of partial combustion, the meaning of which is that if more oxygen be added the carbonic oxide will ignite and burn to carbonic acid. These products of partial combustion are thus burned in the carburetor and superheater by admitting air from the blower. The result of this combustion is intense heat, which is taken up by the loose firebrick, or checker-brick, with which the carburetor and superheater are filled. The resulting carbonic acid and nitrogen products of complete combustion then pass off to the atmosphere through the stack valve. The degree and distribution of heat in the carburetor and superheater are entirely under control, and can be adapted to the character of the oil used for carburetting. When the temperature in these various shells is at the proper point, the air blasts are shut off, and all combustion ceases. The stack valve is then closed and steam is admitted under grate in the generator. The passage of this steam through the highly heated fuel produces non-luminous water gas. As this gas enters the top of the carburetor it meets a spray of partially vaporized oil. The gas and the oil vapors pass together over the highly heated surfaces of the checker-brick, and the oil vapors are gasified and fixed in the presence of the non-luminous water gas. The result is a thoroughly fixed and permanent illuminating gas, which passes on to be scrubbed, condensed and purified in the usual manner. This period of gas making is continued until the heat in the apparatus is reduced to a point where it is not advantageous to continue. The oil and steam are then shut off, the stack valve is opened, and the process of blasting and heating up is repeated. Alternations of this heating up, or "blow," and of gas making, or "run," are continued, each of which hardly ever exceeds 6 or 8 minutes in duration, until it is necessary to stop and add fuel, and at longer intervals clean the fire by removing the slag.

As can be seen in the above described process, air is simply introduced to assist combustion; that is, a certain weight of oxygen is required for combining with the heated carbon in the generator in order to form carbonic oxide, and a certain weight of oxygen is required in the carburetor for burning the carbonic oxide and producing intense heat. The amount of oxygen required in the generator for producing carbonic oxide, and the amount of oxygen required in the carburetor for complete combustion can be determined from the amount of carbon that is contained in the fuel fed to the generator. If the amount of carbon is definitely known, the amount of oxygen can also be known, therefore, we can definitely determine the amount or weight of air which must be supplied to the generator in order to obtain efficient combustion of the carbon, and complete combustion of the carbonic oxide. It can, therefore, be seen that the successful with efficient operation of a gas producing plant depends largely upon the consistency of volume, or rather weight, of air supplied, and not upon the pressure under which the air is delivered. If the fire is clean and free from clinkers, ½ pound of air pressure possibly would be sufficient to give the desired quantity of air per minute. If, however, the fire is in an unhealthy condition, owing to the formation of a blanket of clinkers over the grate, a higher pressure to blast the same quantity of air per minute through the fire is required. Therefore, any device which will control the air supplied in such a manner as to deliver a constant weight of air, regardless of the pressure necessary to force this air through the generator, will be the most efficient device for gas making.

Fig. 5 shows a diagrammatic arrangement of a constant volume

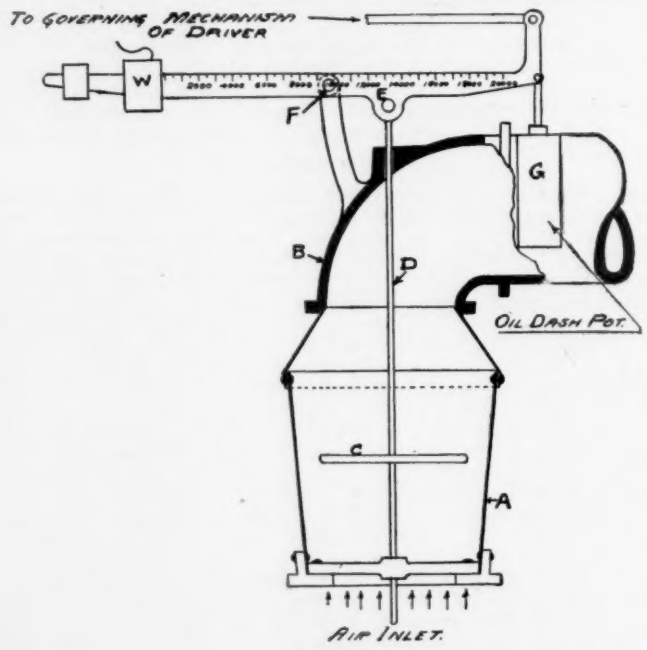


Fig. 5.

governor. This governor is placed on the intake end of the compressor. The air is admitted through a conical pipe *A*, into an elbow *B*, direct connected to the inlet flange of the compressor. In this conical pipe is mounted a horizontal float *C*, suspended from a vertical rod *D*. The latter is connected to a beam *E*, which is free to move about a pin support *F*. The beam is graduated to indicate the amount of air, in cubic feet per minute, that the compressor will deliver if the sliding weight *W* is placed at any certain graduation. An oil dashpot *G* is attached to one end of the beam to dampen down any too violent oscillations. The method of operation of this governor, when furnishing air to the gas making apparatus, is as follows:

Suppose that 14,000 cubic feet of air is to be delivered to the gene rator and carburetor. The sliding weight *W* is set, therefore, at the graduation marked 14,000 cubic feet, and the float, *C*, will assume a definite position with relation to the conical pipe *A*. Let us assume that 14,000 cubic feet of air is being delivered under a pressure of ½ of a pound. If at any instance the fuel in the generator becomes more densely packed, or if the generator is slowly beginning to get into an unhealthy condition, by the formation of a blanket of clinker, the resistance to air flow through the generator is increased. With this increased resistance the compressor can no longer deliver 14,000 cubic feet of air, and we may say that momentarily a less quantity is being delivered by the compressor. Just as soon as this occurs, the float, *C*, can no longer remain in its present position, because it is not sustained by the original volume of air passing by it. As the volume of air decreases the float, *C*, will start to drop in the conical pipe. Just as soon as this occurs, the rod, *D*, will pull the constant volume beam, *E*, into a new position. The end of this beam arm is connected with the governing mechanism of the driver. In the case of a steam turbine drive, it will admit more steam to the turbine and speed it up. In the case of a D.-C. motor-drive it will move the rheostat and increase the speed of the motor; and in the case of an A.-C. electric-drive, it will change the resistance of a water rheostat and thus increase the speed of the motor. Hence, no matter what form of driver is used, this governing mechanism will increase the speed of the driver so that the compressor will run at a higher speed and deliver a higher pressure. The pressure will continue to increase until it is sufficiently high to overcome the added resistances in the gas generator, and thus again force the original quantity of air through the apparatus, in this case 14,000 cubic feet of air a minute. The constant volume governor, therefore, will instantly respond to any change of condition in the gas apparatus, so that if the resistance to air passage is increased, the compressor will speed up and overcome this resist-

ance, and when the resistance is removed, the compressor will slow down again and lower its pressure, but the governor will automatically keep the volume of air supplied by the compressor absolutely constant.

The United Gas Improvement Company has recognized the necessity of supplying a constant volume of air during the process of gas making, and has installed upon the discharge end of the compressor an air meter in the shape of a Venturi meter, which is to measure the amount of air flow on the discharge end of the blower. It can, however, be readily seen that this air meter will not perform the function intended because the pressure on the discharge end of the compressor will continually vary in order to deliver a constant volume. If the air meter registers the correct amount of air or oxygen supplied when the discharge pressure is ¾ of a pound it will no longer register the correct weight of air when the pressure is increased or decreased; that is, the air meter on the discharge end will only measure constant volume at various densities, hence not constant weight of air or oxygen. We know that 14,000 cubic feet of air under ¾ of a pound pressure contains less weight of oxygen than 14,000 cubic feet of air under 1 pound pressure. Hence, the indications of a constant volume at the discharge end of the compressor do not necessarily mean a constant weight of air or oxygen. Again, this meter as installed does not automatically control the supply of a constant weight of air, but simply furnishes a means of indicating what is happening at the discharge end of the compressor, and it is left to the operator to so change the speed of his blower that this volume can remain fairly constant. In all the installations that the author has been able to study it was not possible for the operator to be continually controlling the speed of the compressor so that a constant volume could be secured. The constant volume governor, as described above and illustrated in Fig. 5, is a device that has been patented by the General Electric Company and can be readily applied to their centrifugal compressors. This device, extremely simple and very sensitive, will respond immediately to all variations of resistance in the discharge line and, therefore, will govern efficiently.

It may be interesting to mention before closing that this type of governing apparatus has been installed in a number of cases on centrifugal compressors for delivering air to blast furnaces. The problem of delivering air to a blast furnace is exactly similar to the problem of delivering air to a gas generator. In both cases the air supplied is used for combustion purposes; that is, a definite weight of oxygen is needed for burning the fuel. In the former method of controlling the operation of a blast furnace it was left to the skill of the furnace attendant to observe when a blast furnace was slowly changing its condition. When this occurred he called upon the engineer to speed up or speed down the air compressor so as to deliver a higher or lower air pressure. The change of air pressure was not demanded until the furnace gave visible signs of a change in its condition. By the installation of a centrifugal compressor with a constant volume governor the constant volume governor could be set at any desired amount of air, and the governor would instantly respond to the slightest change of condition before the blast furnace operator could have observed this. The result has been that the centrifugal compressor with a constant volume governor has revolutionized blast furnace operation securing an absolutely constant supply of air no matter what the condition of the furnace; and by responding immediately to slight changes in the condition of the furnace it can keep the furnace under a more normal operating condition and thus both increase the output and its quality.

Fig. 6 is a photographic view of the latest type of multi-stage compressor for blast furnace work, and is one of 3 units furnished to the Iroquois Iron Company, of South Chicago, for delivering air to their blast furnaces. Each unit is capable of delivering 40,000 cubic feet of air a minute against a maximum pressure of 30 pounds. The normal rating of the set is 35,000 cubic feet of air per minute, and 15 pounds pressure. The unit is direct connected to a Curtis steam turbine which delivers nearly 3,000 horse power when the compressor is operating under normal load. The constant volume governor installed upon the air intake of this compressor is direct connected to the controlling mechanism of the turbine and will control the speed of the turbine so that the unit will deliver a constant volume of air against any pressure whatever, up to the maximum pressure, which the blast furnace will stand, which in this case is 30 pounds per square inch

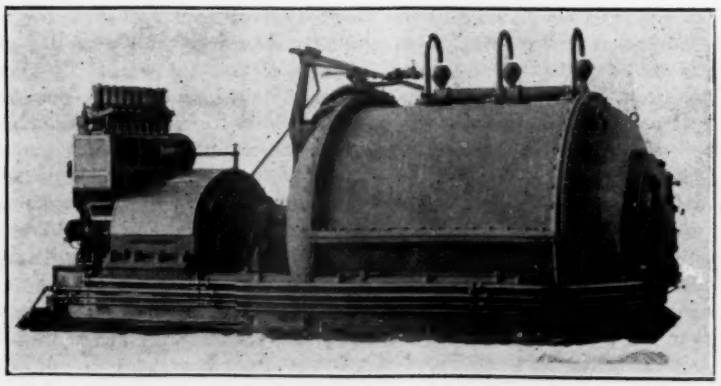


Fig. 6.

There is no doubt in the author's mind that, as soon as a number of single stage centrifugal compressors are installed with constant governors in installations manufacturing water gas, we shall find the same improvement in the quantity and quality of the gas made that has been found in the quantity and quality of the iron manufactured where centrifugal compressors with constant volume governors are employed for blast furnace work.

Discussion.

The Chairman invited discussion on the paper.

Mr. Gartley said he had been interested in what Dr. Lowenstein said, because the subject of getting sufficient blast at sufficient pressures for water gas generation was one that had not been satisfactorily solved. The speaker called attention to the fact that if Venturi meters were put on the outlets of blowers the fluctuation in pressures would introduce variables in the weight of air delivered, which was true, but in practice one would find the percentage of error so introduced was not very great, while in many cases the remedy suggested was entirely impracticable. If they had, as was frequently the case, one blower supplying air to more than one machine, of course the Venturi meter at the inlet to the blower would be of no use in regulating the air to each of the machines so supplied. The solution of the problem would then appear to be put in a separate blower on each machine, but that again introduced other serious difficulties. In blast furnaces they blew the furnace for several hours, whereas in water gas manufacture the object was to get the blow as short as possible. Mr. Glasgow pointed out years ago that there was one condition of the fire most suitable for gas making, and the more that condition was departed from the less efficient the operation became. Consequently, in these days it was not unusual to blow 3 minutes, sometimes even less. Again, in a centrifugal blowing machine supplying the air to one generator in this way, one must either continue the blower at speed through the gas making period as well as the blasting period, or shut it down part of the time. Their experience had been, with a centrifugal blower operated by an electric motor and connected to a 3-million foot generator—*i. e.*, a separate blower to each generator—that the length of time it took to get the blower up to speed, so as to give the pressure desired, was so great that if the machine were shut down during the gas making period, and an attempt made to start it again during the blasting period, the full time intended for the blasting period was consumed in getting the machine to deliver the air in the required quantity and at the required pressure. In order to get the proper delivery of air at the beginning of the blasting period it practically amounted to starting the blower up from rest shortly after the machine was put on making gas, and shutting it down shortly after the blasting period commenced. That, of course, was impracticable. Running the blower throughout the gas making period was wasteful, and this eventually changed from delivering the air to each machine from its individual blowers, to delivering the air into a header from which each machine could take its supply. This resulted in their requiring only 2 blowers where 3 had been used. Having the blowers operated by electric motors in this house, which contains three 3,000,000 cubic foot machines, supplied by a separate wire leading direct to the switchboard, they could plainly see the saving thus effected. Would Dr. Lowenstein answer two questions: First, did the apparatus make much noise? This was asked because noisy apparatus in a gas works was likely to militate against its use; second, if one closed the valve on the outlet, could the apparatus still revolve without fear of accumulating pressure and wrecking?

Mr. Griswold said it seemed to him the difficulty in regard to water gas might be fixed up if Mr. Loewenstein applied one of these governors to each connection to a water gas machine so connected up that

it would operate a valve on that particular line. He would have to provide some other form of governor on his prime mover, to be sure that the maximum pressure necessary would be there to handle any one of the connections, but if it was fixed up in that way, with an individual governor in each connection on each machine, of course one could handle any number of machines from the same header. He did not know though that it would be possible to fix up such a governor as that. Mr. Loewenstein referred to the matter of the Venturi meter. While the speaker had not anything to do with the Venturi meter, it was his impression that it was used to indicate the weight of fluid passing through it instead of the cubic feet.

Mr. Dewey said another point he had in mind, while hearing this paper presented, and on which the Doctor did not touch at all, was the use of the centrifugal machine in the delivery of gas. He would ask what were the particular, peculiar problems encountered in the handling of gas as compared with air? He believed they had gone through that problem in the Worcester (Mass.) plant, and some very interesting problems were found, due to conditions in the specific gravity which one gets in the delivery vanes. Of course, this centrifugal motion or action that you get varies with the specific gravity of the gas. The remark made by Mr. Gartley was one that he intended to make if it had not been brought out. One point not mentioned, however, was the blowing of the water gas machine. They had 2 things with which to contend with, the amounts of air put respectively in the generator, and in the carburetor, and this device here would, of course, regulate the pressure to give a constant volume to the machine, but they also had to have a device to cut down the carburetor valve in direct ratio as the pressure was raised, a very serious matter in the operation of a water gas machine. As a matter of fact, he thought that was a weak point in machine operation. He would also ask would it be possible to develop a machine of the centrifugal type, such as used in cupola practice, that would deliver gas against say 10, 15 or 30 pounds pressure, with the idea of using these as distributing pumps in place of the ordinary rotary compressor as they now had it in a medium pressure and high pressure distribution?

The Chairman called on Dr. Loewenstein to reply.

Dr. Loewenstein—Gentlemen, I am glad these questions were propounded and that I am permitted to discuss them, because it gives me the opportunity to present a more completed paper. Referring to the points raised by the first speaker. It is true that our centrifugal compressors, with constant volume governor, will operate best, when installed separately with each particular gas generator, instead of installing a large unit pumping air into a main supplying a number of gas generators. On the other hand, it is possible to govern the air from a common line, as suggested by the third speaker; but we would recommend a separate air compressor for each furnace, as this would be the ideal arrangement. Installing a separate compressor for each gas generator would not require as much floor space as one would naturally suppose, and if you refer to some of the photographs shown in connection with the paper you will see that the amount of floor space required is very small indeed. As to the question of starting up and shutting down, I was given the privilege, by Mr. Charles F. Prichard, one of your former Presidents, to inspect his gas works at Lynn, Mass., and I observed there a steam-driven, turbo-blower, which was started up from practically standstill to full speed in about 8 to 10 seconds. I should not hesitate to say that a turbo-compressor can be started up and brought to full speed easily within 15 to 20 seconds at the most. These few seconds mean nothing to an operator, as it takes him much longer to open the valves to admit air to the gas generator than to start the compressor set going. The compressor can also be run at full speed with the supply of air entirely shut off, either on the suction or the discharge end. The machine will then perform no work except churning the air inside the compressor casing, and the amount of power required to keep the impeller revolving at speed with no air flow is lost in the shape of heating the air confined in the casing. It is, however, not necessary to keep the compressor running at full speed when the air supply is not needed, for, as said before, the entire set can be started up in a very few seconds. The compressor does not need to build up pressure when the volume of air delivered is not the normal quantity, as these machines will give practically constant pressure from zero quantity of air to overload quantities. The pressure curve varies according to volume something like this (indicating), the vertical line representing pressures and the horizontal line representing volumes. The pressure curve is slightly lower at zero quantity than at rated quantity, and again drops when the quantity becomes too excessive; but the variation in pressure, as you see, is very slight, and we may say that the compressor is a constant pressure machine as long as the speed remains constant. I have noticed the operation of the Venturi air meter at this same plant in Lynn. It was installed on the discharge end of the blower and the indicating U-tube was placed upon the operating platform. I asked the operator what he did with the volume indications on this U-tube, and he told me that he simply looks at it, but he would not have time to regulate the steam admission to his blower, set so as to keep a constant volume indication on the U-tube, and even if he had the time to do it, I am quite sure he would not be able to do it, because he could not continually keep varying the speed as quickly as the volume varies. As a matter of fact, this piece of apparatus is useless as far as the operator is concerned. I noticed at the time that the volume as indicated in the U-tube registered 14,000 cubic feet of air per minute, and after ½ minute run it would drop to 8,000 and again return to 10,000 to 14,000. On the other hand, a constant volume governor, properly installed, will regulate every second of the time and will send a constant weight of air supply through the discharge line. The governor is quite sensitive and will regulate within a few per cent. of the rated volume. The second speaker brought up a very interesting point as to the difference between compressing gas and compressing air. In an ordinary reciprocating compressor it made no difference whether the compressor is compressing air or gas. The power consumed remains the same and the final pressure is practically the same if the reciprocating compressor is running at the same speed in both cases. With a centrifugal compressor this is somewhat different. The centrifugal compressor, as its name implies, produces most of its pressure due to the action of centrifugal force; that is, it entrains air or gas in the impeller at its inner diameter and discharges it at an outer diameter, but at a higher pressure, the increase of pressure being due to the action of centrifugal force. If the impeller is pumping air the centrifugal pressure will be higher than if the same impeller is pumping gas, just exactly the same as if a centrifugal pump were pumping water or pumping mercury. If it is pumping mercury the resultant centrifugal pressure will be much higher than if it were pumping water; that is, the centrifugal pressure is dependent upon the weight of the fluid pumped. Hence, if a certain compressor is compressing air, it will deliver a certain volume against a much higher pressure than if the same compressor were compressing an equal volume of gas, but the power required to compress this air against a higher pressure will be greater than the power required to compress the gas against the lower pressure. If it is necessary, therefore, to use a compressor rated for instance 10,000 cubic feet of air against 1 pound for compressing the same volume of gas against 1 pound, it would be necessary to add another impeller so that a final pressure of 1 pound could be reached with this latter fluid. The power required for compressing the 10,000 cubic feet of gas to 1 pound would be the same, however, as the power required to compress 10,000 cubic feet of air to 1 pound. If certain specifications call for a centrifugal compressor or to compress gas at a certain specific gravity, and if subsequently it was found that this specific gravity was given incorrectly, it is possible to adjust the speed of the compressor within reasonable limits to give the desired pressure. I would, however, recommend that in buying a compressor of this type the specific gravity of the gas to be compressed be accurately determined, in order that the centrifugal compressor furnished will give the required discharge pressure. Answering the question as to whether the pressure of air should only be varied on the generator but not on the carburetor, I feel that what is required is constant volume of air to both generator and carburetor, and not constant volume of air to generator alone. It really makes no difference if the air is introduced to the carburetor at 2½, 2 or 1½ pounds pressure, as long as the quantity of air furnished to both carburetor and generator remains constant, because a certain weight of oxygen is what is needed in both generator and carburetor. I may mention here it is possible to supply with the compressor a constant pressure governor instead of a constant volume governor, if the customer's service so demands, if the pressure governor is very easily installed; in fact, we have 5 machines at present going through the factory, of which 1 or 2 are now in test, which have constant pressure governors and will be installed for furnishing air in the making of coke. The constant pressure device, however, is so universal, and probably so well known, that it is not necessary to enter into its description at the present time. The constant volume governor, however, is an entirely new piece of apparatus that has been revolutionary in character; and, therefore, I have dwelled more upon this mechanism especially, as it is applicable to the needs of a gas generator. As to the use of centrifugal compressor for pumping gas

through gas mains, or for the distribution of gas in any manner whatever, I did not think it was worth while to dwell upon this subject, for it is quite obvious that the centrifugal compressor is admirably adapted to this kind of work. I simply called your attention to the fact that the centrifugal compressor, being more efficient than any other form of air or gas compressing machinery, therefore, must be more efficient when used for distributing gas through gas mains. The use of the centrifugal compressor for pumping gas, as I have said before, is so obvious that I thought it would be better to dwell chiefly upon the use of the compressor for furnishing air to gas generators rather than to the pumping of gas through mains, because the former problem is a more difficult one than the latter. In the first case constant volume of air is required; in the latter case constant pressure is necessary. The constant volume feature is the more novel feature of the two. The third speaker raised the point that the Venturi meter measures volume not weight, and this is the reason that the same volume indications at various pressures or densities do not necessarily mean that it refers to the same weight of air or gas. In supplying air to a gas generator constant weight of oxygen is required, not a constant volume with varying densities. This is the reason that a Venturi meter does not do what it is supposed to do when installed on the discharge end of a compressor. As to the noise of the apparatus, it is rather difficult to answer this question, because it must be defined in terms of some standard of noise. We can, however, say that the centrifugal compressor is not a noisy piece of apparatus. There is no high note or shriek such as would be heard if an impeller were revolving in the open air. When the impeller is inclosed in a casing and is pumping air, no high pitch note is audible. The only other question I have not answered is the question whether in closing the discharge valve the apparatus would be wrecked. I believe I mentioned before that either the discharge or intake may be closed absolutely and the machine kept running at speed and no damage result, because the pressure in the casing in such a case would be slightly less than the pressure at normal rating. It is not possible to overload the casing by excess pressure. There is, however, a likelihood that, when the compressor is brought up to speed with no resistance in the discharge line and with the intake and discharge wide open, the motor of the compressor may be overloaded, and if this motor is an electrical piece of apparatus there is danger of burning it out. Therefore, in starting up a compressor, with no resistance load on the discharge pipe, it is well to start up with the discharge pipe tightly closed, then slightly open the discharge pipe until full load comes to the motor.

On motion a vote of thanks was tendered to Dr. Loewenstein for paper read by him.

The Chairman then introduced Mr. R. G. Griswold (Denver, Col.), who read a paper on

DISTRICT HOLDERS.

[For the text of the Griswold paper, see JOURNAL, Nov. 20, 1911, p.326.]

Discussion.

The Chairman said the paper was open for discussion, which he hoped would be as brisk as possible, as they had another paper, and but little time between the passing of this meeting and the opening of Dr. Bone's lecture. Mr. Forstall?

Mr. W. Forstall—I have not very much to say, and what I do say, is said with diffidence, because I am not a manufacturing man. Mr. Griswold states that "In order to study the possible economies of district holders on the distribution network, the size of holder becomes of importance. There is a variety of opinion as to the holder capacity required for a given sendout. Some plants have a holder capacity equal to the maximum day's sendout, or more, and yet we can all probably recall plants that did not have a holder capacity more than 30 per cent. of the day's sendout, and the service was not impaired. I know of two plants that had no trouble, beyond a little extra vigilance in giving satisfactory service with a holder capacity of 30 per cent. and 25 per cent. respectively of the daily sendout." Personally the speaker believed that nothing save a temporary inability of company to build a holder would excuse a condition of that kind, and he would be interested to hear something regarding the pressure conditions in that town. As said before, he spoke with diffidence, not being a manufacturing man, but he did not want the statement to go on record without some opposing comment.

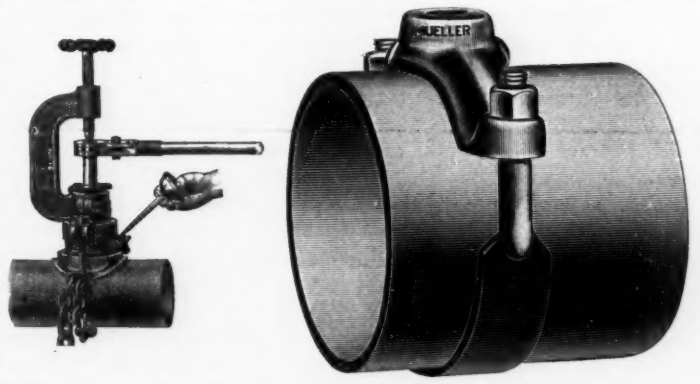
The Chairman called on Mr. Griswold to reply.

Mr. Griswold—As to this 30 per cent. of sendout in storage capacity. he introduced that only to show, as far as the distribution systems are concerned, the 30 per cent. was ample to handle the variations in the load. He did not think it was perhaps safe to run with so little storage, for if anything had happened they would have been down, but, as far as the distribution sytsem is concerned, that storage capacity was ample. It was possible to maintain just the same pressure with that small ratio of storage.

(To be Continued.)

Management & Commercial Methods.

THE MUELLER GAS TAPPING MACHINE AND THE MUELLER CENTURY PATTERN SERVICE CLAMP—Just now the street men (both main and service gangs) are busy; yes, quite busy. The earth, freeing itself from the long rigor of winter, upheaves and crack go the joints, to say nothing of pulled-out services, and the like. So the H. Mueller Manufacturing Company, always alert, and doing the right thing at the right time, is out with a folder, showing amongst other things



kindred to this mention the Company's justly famed No. 16 tapping machine. This machine readily cuts taps ⅜ to 2 inches space in all sizes of pipe, even under pressure. As will be seen from the figure the gooseneck is swiveled to the body and can be at will, and at ease, turned to the most advantageous position for operation. The other shows, without additional need of a descriptive word, a specimen of its "Century Pattern Service Clamp."

Recent Patent Issues.

Prepared for the AMERICAN GAS LIGHT JOURNAL by ROYAL E. BURNHAM, solicitor of patents and counselor in patent causes, 833 Bond Building, Washington, D. C., from whom illustrations and specifications of any patent mentioned below may be obtained for 20 cents.

1,018,675. Meter Support or Shelf. P. Mueller and A. C. Schuermann, Decatur, Ills, assignors to the Mueller Manufacturing Company, same place.

1,018,819. Gas Burner. H. E. Gilbert, Conshohocken, Pa., assignor to John Wood Manufacturing Company.

1,018,832. Process of Operating Gas Producers. N. Latta, San Francisco, Cal.

1,018,969. Incandescent Gas and Like Burner. J. Galile, Nancy, France.

1,019,119. Header for Gas Meters. M. Balbach, Wilkes-Barre, Pa.

1,019,131. Gas Fixture. G. R. Chamberlain and A. G. Schroder, Grand Rapids, Mich.

1,019,132. Gas Fixture. G. R. Chamberlain and A. G. Schroeder, Grand Rapids, Mich.

1,019,159. Automatic Gas Lighter and Extinguisher. G. C. Innes, Boston, Mass., assignor to W. H. Kimball, same place.

1,019,201. Automatic Gas Shut Off. A. R. Tracy, Pateros, Wash.

1,019,298. Gas Burner. G. Bruneau, Clichy, France.

1,019,309. Carbureting Apparatus. R. P. Doudney, Faringdon, England.

1,019,318. Gas Burner. A. Grandjean, San Diego, Cal.

1,019,599. Flashing Gas Sign. W. Clayton-Joel, Melbourne, Victoria, Australia.

1,019,705. Process of Manufacturing Carbureted Hydrogen Gas. W.

J. Watkins, Fort Worth, Tex., assignor to O. G. Hurdleston, same place.

1,019,714. Apparatus for Making Carbureted Hydrogen Gas. J. R. Herndon, Fort Worth, Tex., assignor to Oxine Gas Manufacturing Company, same place.

1,019,741. Safety Gas Burner. N. Wise, New York City.

1,020,168. Process of Purifying Gas and Recovering By-Products. F. H. Wagner, Baltimore, Md.

1,020,255. Manufacture of Incandescent Bodies for Gas Lighting. C. R. Bohm, Berlin, Germany.

1,020,339, Condenser for Gas Apparatus. E. R. Angell, Derry, N. H.

Gas and Ammonia from Peat.

The *Gas World* notes that in an address before the last annual meeting of the Lower Saxony (Ger.) District Gas Association, Prof. A. Frank, of Charlottenburg, gave an account of what he described as the youngest branch of the gas industry, the recovery of engine gas and ammonia from peat. After noting the expansion of the German coal industry in its two branches, ordinary coal and brown coal, which rose to 153 and 69½ million tons, respectively, in the year 1910, he referred to the difficulties encountered in endeavoring to utilize the wide stores of peat as a fuel. Peat is too bulky and contains too much water, and all attempts to use it directly came to nothing, except under special circumstances, the bulkiness of it being the main difficulty, which made the use of it as a fuel too costly in any form. In Holland, with its system of canals, a good deal had been done in this direction, land being stripped of peat and reclaimed for agricultural purposes; but the same conditions do not obtain in the German peat lands which are not far short of 1,000 square miles in area, with a depth of about 10 feet of peat, of which 12 per cent. is combustible when dried. The problem now is, if the peat fuel cannot be brought to the industries, cannot the indsutries be brought to the peat fuel? And this appears to have been now fully solved. Modifications, by the author and Prof. Caro, of the Mond gas process, have resulted in a gas containing CO_2 17.4 to 18.8, CO 9.4 to 11, H 22.4 to 25.6, CH_4 2.4 to 3.6, N 42.6 to 46.6, with mere traces of oxygen, and in a profitable recovery of the nitrogen in the peat. The heating value of the gas is 157.3 B.T.U. per cubic foot, which is about 50 per cent. above the lower limit of heating value suitable for use in gas engines; and at Solingen, the peat, which contains 1.15 per cent. nitrogen, gives sulphate of ammonia to the extent of 4 per cent. of the weight of the dried peat. Wood spirit and acetic acid also appear as products. The work has now been taken up in earnest near Osnabrück, and 3,000 horse power electric energy is being supplied to the town and district, all from the peat gas. Each 1,000-horse power per annum will cause the stripping of 10 acres of peat moor to a depth of 10 feet. The soil laid bare is good for agricultural purposes, so that land is steadily being reclaimed and inhabited. The large yields of sulphate of ammonia bid fair to play a large part in supplying the demand, which is now outstripping the supply, great though this now is, the production in German gas works and cokeries having risen from 132,000 tons in 1902 to 373,000 tons in 1910.

Bureau Methods for Analyzing Coal and Coke.

In order to supply the constantly increasing demand for information relating to the methods used by the Bureau of Mines in analyzing coal and coke, the Bureau has just issued Technical Paper No. 8, by Mr. F. M. Stanton and Mr. Arno C. Fieldner. This technical paper describes the methods in use at the laboratories of the Bureau for analyzing coal and coke, and determining the heating value of these fuels.

The fuel investigations being conducted by the Bureau of Mines had their inception in the work done by the Government coal testing plant, erected in 1904, at the Louisiana Purchase Exposition, St. Louis, Missouri, and the analytical methods originally used by the chemists at that plant have been followed, without much change, in the subsequent chemical work of the fuel-testing plants at St. Louis, Norfolk and Pittsburgh. The paper describes the original methods (which were those recommended by the committee on coal analysis of the "American Chemical Society") and such modifications and changes as experience has shown advisable. Copies of Technical Paper No. 8 may be obtained by writing to the Director of the Bureau of Mines, Washington, D. C.

Items of Interest
FROM VARIOUS LOCALITIES.

THE proprietors of the Rutland (Vt.) Railway, Light and Power Company have authorized Superintendent W. H. Lawson, who has direct charge of the gas division of the Company's trading, to enter into a contract with the Davis & Farnum Manufacturing Company, of Waltham, Mass., for the construction of a storage holder, up to retaining 100,000 cubic feet. It is to be of steel material, is to be of the double-lift order, and will be located not far from the present holder, at a suitable place on the Cleveland avenue site. Work on the vessel will be commenced as soon as the frost is out of the ground. Mr. Lawson has also arranged for a sensible addition to the main system, and that he seems to be quite a successful hustler is evidenced from the fact that 1,400 gas ranges are in use in the district supplied, and that close to 2,000 separate meters are on the Company's lines.

IT looks that Athens, Ga., is at last to have a gas plant, the proposers of the Athens Gas Light and Fuel Company (capitalized in $250,000) being Messrs. Jno. Gribbel, F. Newbuyer and W. H. Roberts, Jr., who applied to the authorities for a necessary rights. The names of the men making this application are sufficient guarantees that the enterprise will be carried on along lines that will be satisfactory to the residents and satisfying to the promotors.

MR. ANDREW H. GLENDENNING has been appointed Agent and Manager of the Bayonne (N. J.) Public Service Gas Company vice Mr. Henry A. Wheeler, resigned. Mr. Glendenning has been with the Public Service Gas Company, and its predecessors, for 22 years, having served in a clerical capacity the old Jersey City and the Newark Gas Companies. He is an excellent accountant and a good office controller. Mr. Wheeler's retirement was brought about through the automatic action of the Company's pension system. He also was connected with the predecessor Companies to the existing organization, and his service in the gas industry of New Jersey covers a period of 25 years.

MR. JOSEPH H. HAELFELIN, yard superintendent of the New York Consolidated Gas Company's station at 65th street, died at his home, 3924 Broadway, the morning of Friday, the 15th inst. He was in his 65th year, 30 years of which were spent in the service of the Consolidated Gas Company and its predecessors. Two sons and two daughters survive him.

THE Trustees of Fresno, Cal., have ordered that, beginning the 1st day of next October, the gas rate in that city shall not exceed $1 per 1,000 cubic feet.

L. J. DOWNER, of Philadelphia; T. L. O'Donnell, of St. Clair, Pa.; and B. W. Cumming, of Pottsville, Pa., are anxious to construct a plant for the supply of the residents of St. Clair, Frackville and Gilberton with gas. They estimate that the cost of plant installation—including main system complete—will be not less than $100,000.

AT a recent meeting of the Directors of the Union Gas and Electric Company, of Cincinnati, O., the resignation of Mr. Norman G. Kenan, as President, was accepted, and Mr. Archibald S. White was elected President; Mr. Rollin W. White (who had been acting as President and General Manager) was continued as Vice-President and General Manager. Mr. Theodore Claus was re-elected Secretary, and Mr. W. T. Hunter continues as Treasurer.

THE Consumers Gas Company, of Princeton, Ind., has been purchased by Messrs. H, J. Peckinpaugh, P. J. Scheller and Henry Dannettell, all of Evansville, Ind., and will be operated by them hereafter. Mr. Dannettell will succeed Mr. J. E. Joyce, as Manager, and Mr. Scheller will have charge of the office. The trio named are also engaged in the construction of an artificial gas plant in Edwardsville, Ills., which place is close to the Southeast line of St. Louis.

ON the 11th inst., several employees of the Montgomery County, Norristown (Pa.) Gas Company, the Norristown Electric Light and Power Company and the Norristown Steam Heat Company, met in Norristown and formed the Gas-el-ste-cos Club. The officers elected were: President, H. F. McPeck; Vice-President, Howard Jones; Treasurer, Chas. H. Gotwals; Secretary, Jno. B. McDermott. It was decided to hold monthly meetings, the proceedings of the sessions

to be in line with those governing other bodies of like nature throughout the county. It is proposed to have dialogue debates and memorandum criticisms as well, on any and all matters tending to put the Company and its men in advancing position. Lectures will be arranged for. And it may be taken as granted that the social side will, in no sense or way, be slighted.

"W. T. U.," writing from Ironwood, Mich., under date of the 15th inst., notes that Mr. E. L. Lambert, since 1910 Superintendent of the Ironwood and Hurley (Mich.) Gas Company, and of the Iron Mountain (Mich.) Light and Fuel Company, has been transferred to the Temple (Tex.) Gas Light Company, at which point it is thought will be turned on the first time about the 1st prox. The Temple plant, by way of a better understanding, is being constructed by the people most in interest in the Hurley-Ironwood district.

MR. JAMES GAMBLE has associated with Mr. H. F. Weber, in the formation of the firm of Gamble and Weber, with headquarters in 15 William street, New York city. They will engage in the construction of gas and water works, electric light plants, and the like. Mr. Weber was formerly Mechanical Engineer with the Electric Bond and Share Company, and resigned therefrom to go into the business in a direct personal way. As to Mr. Gamble it is scarcely necessary to say anything. Having been connected with the lighting industry for many years, he is rightly entitled to consider himself a veteran in the ranks.

MR BIRD S. COLER, President of the North Carolina Public Service Corporation, which operates electric railways in Charlotte, Greensboro and High Point, N. C., and which controls the gas and electric lighting enterprise at Charlotte and Spencer, N. C., recently appeared before the Salisbury Board of Aldermen, at a called meeting of that body, and applied for franchise concessions permitting the extension of the railway, gas and electric light and power plant in Salisbury to other contiguous points.

THE Sprague Meter Company has opened a warehouse, at No. 113 East Front street, Davenport, Ia., in which will be carried a complete line of meters, meter parts, regulators, etc. The branch and warehouse will be in charge of Mr. E. C. Falvey, formerly of Bridgeport, Conn.

A RECENT issue of the Louisville (Ky.) *Post* had this to say: "The officers of the Louisville Gas Company and the Kentucky Heating Company have commenced a crusade among users of gas for lighting purposes, which is aimed at preventing the use of the product of the Kentucky Heating Company for such account. It is said that several thousand meters of the Kentucky Heating Company have been removed from houses in which the gas was being used for lighting purposes. This movement became effective shortly after General George H. Harries was elected President of the Louisville Gas Company, when he organized a force of inspectors to make a tour of the city to take the number of each house structure in which mantle burners were being used. These house numbers were compared with the records of the Louisville Gas Company, and wherever it was found that the Louisville Company was not furnishing the gas the meter was cut out. General Harries and President McDonald held a conference, the outcome of which was that the latter agreed to co operate with the former, and immediately set a force of gas fitters on the work of taking out meters from houses in which gas from the Kentucky Heating Company was being used for purposes of illumination." This action (and many wondered why it was not taken under the Presidency of Mr. Sackett) is in accordance with a decision of the United States Supreme Court under which it was ordered that the Kentucky Heating Company be estopped from supplying gas to be used for any other purposes than for heating and power. This action even though it is taken at so late a day, must cause the facial muscles of that, prince of old-time gas men (Mr. A. H. Barret) to convulsively relax.

MR. SAMUEL C. SHAFFNER, well and favorably known to the Southern gas men, during his period of managing the Mobile (Ala.) plant, when that was owned by that other prince of gas capitalists (Mr. S. S. Rubira), has been appointed General Manager of the Eastern Penn Power Company, the headquarters of which are in Easton, Pa.

MR. A. M. SUTHERLAND, under whose contract obligation the works of the Albany (Ga.) Gas Company are to be built, has retained Mr. W. H. Fritchman to superintend the work of construction.

"B. B. M.," writing from Pen Argyl, Pa., under date of the 19th inst., says: "The annual meeting of the shareholders of the Pen Argyl Gas Company was held some days ago. The Directors elected were: E. A. Spear, C. N. Miller, C. M. Smith, J. R. Whitney, W. M. Bennett, Walter Ede and M. Flory. The Directors subsequently organized by making these choices: President, E. A. Spear; Vice-President, Walter Ede; Secretary and Treasurer, C. M. Smith. The business having been disposed of the shareholders (including several ladies) shared in a chicken and waffle supper, well served in the dining room of the Realty Cafe. The proprietors (Messrs. Martin & Aug) gave their guests a beautifully practical demonstration of the value of gas iu the kitchen. Each guest received as a favor a miniature gas hot plate with cookies on a pan."

MR. FRANK D. CHASE, Assoc. Mem., Am. Sec. Civil Engrs., informs us that he has opened an offiee in the Peoples Gas Building, Chicago, from whence to conduct the practice of architecture and industrial engineering, with special reference to structures of the type used for housing large or small manufacturing plants and mercantile buildings of the modern sort as well. Mr. Chase is well-known in the electrical circles of Illinois and Ohio, through his connection with the Western Electric Company.

MR. L. B. PAXTON is informed that the officers of the Company that is proposing to supply gas to the residents of Turlock, Cal. (the Turlock Gas Company) are: Directors, A. A. Caldwell, A. J. Eddy, E. P. Mains, A. G. Chatom and B. R. Fowler; President, A. A. Caldwell; Secretary, E. P. Mains; Attorney, B. R. Fowler.

TO-MORROW the North Hempstead (Long Island, N. Y.) Town Board will consider a petition from certain parties for the right to supply gas in that district. A 50-year franchise will be asked for, and it is understood that those in interest propose to secure grants along a line through Douglaston, Little Neck, Manhanset, Roslyn, etc. We are told that the people behind this movement are decidedly anxious to go on with this work; further, we know that they are up to any contracts into which they enter, be the tentative value of such contracts well into the millions. They are practical gas men, too; in fact, none other in America are better posted respecting every ramification of the business.

THE City Council of St. Catharines, Canada, has passed to second reading a by-law to purchase the plant and business of the St. Catharines Artificial Gas Company, for ownership and operation on public account. The authorities now own $27,500 in the stock of the Company, and the by-law proposes to take over the balance through payment therefor of $38,000. If this by-law is not ready for submission to the people at the election to be held the 3d prox., it will be necessary to postpone adjudication for another twelvemonth.

SOME days ago the gas plant at or in Tonopah, Nev., was badly damaged by fire. It will be restored at once to working usefulness.

"B. M. B.," writing from Dallas, Tex., under date of March 14th, says: "We are certainly going ahead on gas lines in this thriving city of the 'Big State.' For instance, in 1909-10-11 (to Jan. 1, 1912) 77 miles of distributing mains were buried, bringing the total to 158 miles—in the 3 years the main system was virtually doubled. It is also worthy of note that the diameters were between these figures: Maximum, 16 inches; minimum, 4 inches. In 1911 service connections numbering 2,258 were made—these took up a total length of 26 miles. Nine new balancing stations were cut in, bringing the total central stations to 19. There are not less than 10,000 users of gas in Dallas, several of those using 400,000 cubic feet per month." In closing our correspondent says: "Although great work was done along extension lines in 1911, that which will be done in the current year will undoubtedly exceed the former, since it is about settled that much of the territory southwest of the Fair Grounds, into East Dallas, Junius Heights, etc., will be hooked up."

The Market for Gas Securities.

The week's work shows no change in quoted values for city gas securities. In fact the break for the 7 days is about even. Consolidated came in this morning at 141½ to 142. Last week it was 141⅞ to 142. Talk about the "Camp Fires of Napoleon." These were never in it with this winter's tale of the "Bonfires of the Consolidated," to say nothing of the like signals of the Brooklyn Union. Everywhere one turns it is not difficult to encounter the street gangs combatting with or tracing down gas escapes. Possibly the solace in this line lies along the fact that these "huntings" go to show how well-managed and instantly useful are emergency crews of both Companies, especially of the "big one."

Brooklyn Union is 138 to 139½, or about 70 per cent. below its real value. However, investors will wake up to this disparity before long. Peoples, of Chicago, is about a point higher; it is also in quite some demand. Take it from us, President Meagher looks like the goods. Washington gas keeps showing unwonted strength. Last week the transfer of quite a block of it happened. The shares had been in the control of the sellers or their former relatives for 40 years. Yes; there will be plenty doing in Washington gas matters before the summertime is really here. Lacledes are up a point.

Gas Stocks.

Quotations by George W. Close, Broker and Dealer in Gas Stocks.

115 BROADWAY, NEW YORK CITY.

MARCH 25.

☞ All communications will receive particular attention.

☞ The following quotations are based on the par value of $100 per share:

N. Y. City Companies.	*Capital.*	*Par.*	*Bid.*	*Asked*
Consolidated Gas Co.	$78,177,000	100	141⅛	142
Central Union Gas Co.—				
1st 5's, due 1972, J. & J.	8,000,000	1,000	103	105
Equitable Gas Light Co.—				
Con. 5's, due 1932, M. & S.	1,000,000	1,000	105	106
Mutual Gas Co.	3,500,000	100	165	175
New Amsterdam Gas Co.—				
1st Con. 5's, due 1948, J. & J.	11,000,000	1,000	101	102⅛
New York & Richmond Gas				
Co. (Staten Island)	1,500,000	100	35	50
1st Mtg. Gold Bds. 5 p. ct.	1,500,000	—	98¼	100½
New York and East River—				
1st 5's, due 1944, J. & J.	3,500,000	1,000	103	105
Con. 5's, due 1945, J. & J.	1,500,000	—	95	100
Northern Union—				
1st 5's, due 1927, J. & J.	1,250,000	1,000	100	109
Standard	5,000,000	100	60	70
Preferred	5,000,000	100	90	100
1st Mtg. 5's, due 1930, M. & N.	1,500,000	1,000	103	105
The Brooklyn Union	15,000,000	1,000	138	139½
1st Con. 5's, due 1948, M. & N.	15,000,000	—	106¾	107
Yonkers	299,650	500	130	—
Out-of-Town Companies.				
Bay State	50,000,000	50	⅛	¾
" Income Bonds	2,000,000	1,000	—	75
Binghampton Gas Works	450,000	100	—	—
" 1st Mtg. 5's	500,000	1,000	97	100
Boston United Gas Co.—				
1st Series S. F. Trust	7,000,000	1,000	82	85
2d " " "	3,000,000	1,000	47½	50
Buffalo City Gas Co.	5,500,000	100	5	8
Bonds, 5's	5,250,000	1,000	59	60
Capital, Sacramento	500,000	50	—	35
Bonds (6's)	150,000	1,000	—	—
Chicago Gas Co. Guaranteed				
Gold Bonds	7,660,600	1,000	104	106¼
Cincinnati Gas and Electric				
Co.	29,500,000	100	87	90
Columbus (O.) Gas Co., 1st				
Mortgage Bonds	1,500,000	1,000	96	98
Columbus (O.) Gas Lt. &				
Heating Co.	1,662,750	100	90¼	91
Preferred	3,026,500	100	75½	80
Consumers, Toronto	2,000,000	50	200	204
Consolidated, Baltimore	13,460,084	—		—
Mortgages, 5's	3,400,000	—		—
General Mortgage 4½	10,661,000	—		—
Con. Gas Co., Baltimore				
City, 4½	2,751,000	—		—
Consolidated Gas Co. of N. J.	1,000,000	100	15	—
Con. Mtg. 5's	976,000	1,000	94	96
Bonds	75,000	—	—	100
Essex and Hudson Gas Co.	6,500,000	—	133	136
Fort Wayne	2,000,000	—	—	—
" Bonds	2,000,000	—	55	—
Grand Rapids Gas Light Co.,				
1st Mtg. 5's	1,350,000	1,000	100	101
Hartford	750,000	25	190	200
Hudson County Gas Co., of				
New Jersey	10,500,000	—	133	138
" Bonds, 5's	10,500,000	—	101	106
Indianapolis	2,000,000	—	—	38
" Bonds, 5's	2,650,000	—	104½	105
Jackson Gas Co.	250,000	50	82	—
" 1st Mtg. 5's	290,000	1,000	91	95
Kansas City Gas Light Co.,				
of Missouri	5,000,000	100	—	86
Bonds, 1st 5's	3,822,000	1,000	99	102
Laclede Gas Co., St. Louis.	10,000,000	100	105	105½
Preferred	2,500,000	100	114	120
Bonds	10,000,000	1,000	102¼	103
Lafayette Gas Co., Ind.	1,000,000	100	—	60
Bonds	1,000,000	1,000	60	65
Louisville	2,570,000	50	143	145
Madison Gas and Electric Co.				
" 1st Mtg. 6's	400,000	1,000	106	108¾
Massachusetts Gas Companies, of Boston	25,000,000	100	93¾	94
Preferred	25,000,000	100	98⅜	98½
Montreal Gas Co., Canada	2,000,000	100	218	218¾
Nashville Gas Light Co.	1,000,000	100	110	—
Newark, N. J., Con. Gas Co.	6,000,000	—	97	98
Bonds, 6's	6,000,000	—	127	128
New Haven Gas Co.	2,000,000	25	200	—
Peoples Gas Lt. & Coke Co.,				
Chicago	25,000,000	100	107⅛	107⅝
1st Mortgage	20,100,000	1,000	102	102½
2d "	2,500,000	1,000	104	—
Rochester Gas & Electric Co.	2,150,000	50	88	—
Preferred	2,150,000	50	118	—
Consolidated 5's	2,000,000	—	104⅜	105½
Pacific Gas and Electric Co.	15,500,000	—	5⅜	55
St. Joseph Gas Co.—				
1st Mtg. 5's	1,000,000	1,000	96	98
St. Paul Gas Light Co.	2,500,000	100	—	—
1st Mortgages, 6's	650,000	1,000	104	105
Extension, 6's	600,000	1,000	112½	115
General Mortgage, 5's	3,447,000	1,000	94	96
Syracuse Gas Co., N. Y.	1,975,000	100	50	55
Bonds	2,047,000	1,000	101	103
Washington (D. C.) Gas Co.	1,800,000	200	425	427½
1st Mortgage, 6's	600,000	—	—	—
Western Gas Co., Milwaukee	4,000,000	—	—	—
Wilmington (Del.) Gas Co.	600,000	50	—	—

MEETING TIMES OF THE VARIOUS GAS ASSOCIATIONS.

American Gas Institute.—Annual meeting, October 16 to 18, 1912. Atlantic City, N. J. Officers: President, Ira C. Copley, Aurora, Ills. Secretary, Geo. G. Ramsdell, 29 West 39th st., N. Y. City.

Canadian Gas Association.—Annual meeting, ———— Officers: President, Arthur Hewitt, Toronto, Ont.; Secretary and Treasurer, John Keillor, Hamilton, Ont.

Empire State Gas and Electric Association.—Annual meeting, New York City, Oct. 1912. Officers: President, R. M. Searle, Rochester, N. Y.; Secretary, C. H. B. Chapin, 29 W. 39th street. New York City.

Gas Meters.—Monthly meetings. Chairman, I. W. Peffy; Secretary, H Thurston Owens, 42 Pine street, New York City.

Guild of Gas Managers of New England.—Annual meeting, March, 1913. Young's Hotel, Boston; monthly meeting, second Saturday. Officers: President, Walter G. Africa, Manchester, N. H.; Secretary, H. K. Morrison, Brockton, Mass.

Illinois Gas Association.—Annual meeting, time, March 20 and 21, 1912, Auditorium Hotel, Chicago, Ills. Officers: President, C. B. Strohn, Elgin, Ills.; Secretary-Treasurer, F. E. Newberry, Dixon, Ills.

Illuminating Engineering Society.—Annual meeting, Sept. ————1912, ———— Meetings of Sections, monthly. Pres't, V. B. Lansingh, New York City; Secretary, Preston S. Millar, 29 W. 39th street, N. Y. City. Sections: New York, Secretary, Albert J. Marshall, 16 East 40th street. New England, Secretary, H. C. Jones, 10 High street, Boston, Mass. Philadelphia, Secretary, L. B. Eichengreen, Broad and Arch streets. Chicago, Secretary, Edward Wray, 105 N. LaSalle street.

Indiana Gas Association.—Annual meeting, March, 1913, Indianapolis. Officers: President, Howard L. Olds, Indianapolis; Vice-President, Wm. Wallace, Lafayette; Secretary-Treasurer, Philmer Eves, Indianapolis.

Iowa District Gas Association.—Annual meeting, time, May, 22, 23 and 24, 1912; Lincoln, Neb. Officers: President, G. W. Clabaugh, Omaha, Neb.; Secretary and Treasurer, G. I. Vincent, Des Moines, Ia.

Kansas Gas, Water and Electric Light Association.—Annual meeting, time, Oct. 17-19. Manhattan, Kas. Officers: President, B. F. Eyer, Manhattan, Kas.; Secretary and Treasurer, J. D. Nicholson, Newton, Kas.

Michigan Gas Association—Annual meeting, time, Sept. ————1912;———— Officers: President, F. W. Blowers, Kalamazoo, Mich; Secretary-Treasurer, Glenn R. Chamberlain, Grand Rapids, Mich.

Missouri Electric Light, Gas, Water Works and Street Railway Association.—Annual meeting, April 11-13, 1912; Joplin, Mo. Officers: President, F. E. Murray, Louisiana, Mo.; Secretary and Treasurer, N. J. Cunningham, Springfield, Mo.

National Commercial Gas Association.—Annual meeting, Dec. 2-5, 1912. Atlanta, Ga. Officers: President, C. L. Holman, St. Louis, Mo.; Secretary, Louis Stotz, 29 West 39th street, New York City.

Natural Gas Association.—Annual meeting, May, 1912, Kansas City, Mo.; Officers: President, A. B. Macbeth, Independence, Kas. Secretary, T. C. Jones, Delaware, O.

New England Gas Association.—Annual meeting, February,————1913. Boston. Officers: President, D. D Barnum, Worcester, Mass.; Secretary-Treasurer, N. W. Gifford, East Boston, Mass.

New Jersey State Gas Association.—President, William H. Pettes, Newark, N. J.; Secretary-Treasurer, Arthur H. Osborn, Belmar, N. J.

Ohio Gas Association—Annual meeting, February ———, 1913, Columbus, O.; President, John M. Garard, Columbus, O.; Secretary, L. B. Denning, Columbus, O.

Oklahoma Gas, Electric and Railway Association.—President, Noel R. Gascho, Alva Okla.; Secretary, H. V. Bozell, Norman, Okla.

Pacific Coast Gas Association.—Annual meeting, San Diego, Cal., September 17, 18, 19, 1912. Officers: President, W. Baurhyte, Los Angeles, Cal.; Vice-President, Henry E. Adams, Stockton, Cal.; Secretary-Treasurer, John A. Britton, 445 Sutter street, San Francisco, Cal.

Pennsylvania Gas Association.—Annual meeting, Williamsport, Pa., April 10-12, 1912. Officers, President, W. R. Rhodes, Williamsport, Pa.; Secretary-Treasurer, W. O. Lamson, Jr., West Chester, Pa.

Society of Gas Lighting.—Annual meeting, Dec., 13, 1912; monthly meeting, second Thursday. Place, New York City. Officers: President, Fred. S. Benson; Secretary, George G. Ramsdell, 29 West 39th street, New York city

Southern Gas Association.—Annual meeting, April 17-19, 1912, Jacksonville, Fla. Officers: President, H. B. Hoyt, Jacksonville, Fla.; Secretary-Treasurer, R. D. Brewer, Atlanta, Ga.

Southwestern Electrical and Gas Association.—Annual meeting. April 25, 26, 27, 1912, San Antonio, Tex. Officers: President, J. E. Carroll, Beaumont, Tex.; Secretary, D. G. Fisher, Dallas, Tex.

Wisconsin Gas Association.—Annual meeting, May 15 and 16, 1912, Milwaukee, Wis. Officers: President, H. M. Buck, Waukesha, Wis.; Secretary-Treasurer, Henry Harmon. Milwaukee, Wis.